The Glass Industry

PUBLISHED MONTHLY AT NEW YORK

Copyright, 1921, by Glass Industry Publishing Company, Inc.
Vol. 2 JANUARY, 1921 No. 1

Some Common Defects Occurring in Glass

Suggestions for Eliminating Seeds and Stones

By J. B. KRAK*

(*Written for* THE GLASS INDUTRY)

"It came to pass, as a certain merchant vessel sailed that way, laden with nitrum, the passengers went to land for to repose themselves, and to take some store of fresh water into their vessel. Being also on the shore they kindled a fire and made provision for their repast, but (because they wanted trevits or stones whereon to set their kettles) ran by chance into the ship and brought great pieces of nitrum with them, which served their turns for the present. To be short, the said substance being hot, and beginning to melt, it mixed by chance with the gravel that lay under it, and so brought forth that shining substance which now is called GLASS, *and about the time of Semiramis."*

From such crude beginnings to modern automatic bottle- and sheet glass machinery is a long way. The chemical side of glass making, however, has not kept pace with the mechanical development. In many glass factories the mixing room is still a sanctum sanctorum, from which all but the initiated are carefully excluded, and some of the formulæ found in note books of batch mixers remind one of the descriptions found in the works of alchemists. It is only natural that glass is often produced which does not have the desired properties, due to variation in the composition of raw materials. It may be too hard, or too soft; there may be excessive breakage, rapid deterioration of the glass after exposure to moisture, devitrification, seeds, stones, waves and other troubles, for which an explanation cannot often be found. The complaints are usually directed against the manufacturer of the soda ash or salt cake or, simpler yet, the trouble is ascribed to "bad luck."

In order to conduct a chemical industry efficiently it is necessary (1) to know the composition of the raw materials, (2) to control the chemical reaction step by step, (3) to know the composition of the finished product, (4) to have every detail of the manufacturing process scheduled and standardized. Many chemical processes, far simpler than glass making, are controlled in the manner described, because it pays to do so. Glass making should be controlled with the same care as steel making, and until this is done the industry will continue to experience losses which can and should be avoided. In many factories the cost chargeable to glass troubles exceeds by far the salary of an experienced glass chemist and the running expenses of a laboratory. Where a number of small glass factories are located in the same town it would be advantageous to establish a laboratory on a co-operative basis. The share borne by each concern would be small in comparison to the benefits received, even if only routine analyses were made of raw materials, batches, fuels and the finished product, with an occasional checking up of pyrometers.

Let us consider some of the common defects of glass, endeavor to point out their causes and, if possible, suggest remedies. The most frequent trouble, and one to which practically no factory is immune, is the appearance of seeds or blisters. While no glass maker can always avoid them, yet in nearly every case the cause can be found and faulty conditions remedied.

SEEDS OR BLISTERS

Seeds or blisters are gas bubbles which remain in the glass. The gas may be air, carbon dioxide, sulphur dioxide or carbon monoxide. They may be caused (1) by lack of heat, (2) by excessive heat, (3) carelessness in the mixing of the batch, (4) excessive alkali in the batch, (5) insufficient air to allow complete combustion of the fuel gases, (6) faulty construction and lack of room in the combustion space.

The reaction between sand and soda ash yields two products, one of which is a gas:

$$\underset{\text{Soda ash}}{Na_2CO_3} + \text{heat} = \underset{\substack{\text{Sodium}\\\text{oxide}}}{Na_2O} + \underset{\substack{\text{Carbon}\\\text{dioxide}\\\text{(gas)}}}{CO_2} \quad (1)$$

$$Na_2O + \underset{\text{Sand}}{SiO_2} = \underset{\substack{\text{Sodium}\\\text{metasilicate}}}{Na_2SiO_3} \quad (2)$$

* Formerly Chemist, United States Window Glass Company.

Adding equations (1) and (2) we have:

$$Na_2CO_3 + SiO_2 + \text{heat} = Na_2SiO_3 + CO_2 \quad (A)$$

A similar reaction takes place between limestone and sand.

$$\underset{\substack{\text{Limestone,}\\\text{calcium-}\\\text{carbonate}}}{CaCO_3} + \underset{\text{Sand}}{SiO_2} + \text{heat} = \underset{\substack{\text{Calcium}\\\text{metasilicate}}}{CaSiO_3} + CO_2 \quad (B)$$

The products of reactions (A) and (B) are glass, having a normal composition of $Na_2O.CaO.5SiO_2$, and carbon dioxide gas. This example applies with more or less variation to every glass making reaction and may be considered as typical. The by-product of every glass, therefore, is a large amount of gas, and unless the latter is completely eliminated from the molten mass, seeds will appear.

To effect a complete reaction between the component parts of the batch it is necessary, (1) that the parts are present in proper proportions and are carefully mixed, (2) that the temperature is sufficiently high, nor yet too high for the reaction, (3) that enough time is allowed for the fusion to take place. If these conditions are fulfilled the gases will escape when formed, and the glass will have the desired properties. If, however, the molten mass is too viscous, some of the gas bubbles will fail to reach the surface and seedy glass is the result. High viscosity may be due to two causes, lack of fluxes, which raises the fusion point to a degree above the capacity of the furnace, or to lack of heat. To a certain extent these two factors may be adjusted to suit one another. When there is insufficient heat the batch may be made richer in alkali, or a mixture of soda and potash may be used, which lowers the fusion point. It is especially then that caution should be exercised, as an excess of alkali may cause glass to become worthless after a short time.

Even if the temperature is high enough for a complete reaction, yet some of the gas may fail to be eliminated, due to pressure of the same gas in the atmosphere directly above the molten mass. Decomposition of soda ash and limestone by heat can only be complete if the gas resulting therefrom is removed from the air. If the pressure of carbon dioxide exceeds certain limits, varying with the temperature, a condition of equilibrium sets in by which sodium oxide and calcium oxide take up as much carbon dioxide from the atmosphere as is given off. Since carbon dioxide is formed by the combustion of fuel, it is clear that unless there is a sufficient draft it may be impossible to drive all the gas from the molten mass, and seeds and blisters are the result.

Too high a temperature or too much alkali may cause seeds through volatilization of the fluxes. Microscopic examination shows the deposition of minute white specks on the walls of the blisters, found under these conditions.

When glass is heated with a smoky flame seeds may appear, which have been ascribed to solubility of carbon monoxide in liquid glass.[1] On cooling the solubility of this gas is decreased and it appears as very small seeds.

Large blisters are often caused by metallic iron, which may be introduced with the cullet or by accidentally dropping an iron tool in a tank of glass. The only remedy is the removal of the metal from the pot or tank, which often is very difficult and costly.

[1] M. Muller, Sprechsaal, 1881, 95.

Air bubbles are caused by carelessness of the blowers. They correspond to blisters formed in the casting process, when the glass is not poured out in a continuous stream. Air blisters may also occur shortly after the replacement of floaters; they always disappear after sufficient time has elapsed and the proper temperature has been restored.

The foregoing shows that it is impossible to decide offhand what causes glass to be seedy. It depends entirely on conditions, and no remedy can be suggested without a careful study of each individual case. Seedy glass can be avoided by rigid temperature control, regulation of the stack draft, and proper compounding of the batch. Sometimes it is possible to improve seedy glass by causing a strong evolution of gas which removes seeds held by excessive viscosity. If a potato or onion is thrown in the pot the rapid decomposition of the organic matter causes a violent boiling, giving the seeds an opportunity to reach the surface. Part of the beneficial action of arsenic is due to the rapid volatilization of this substance. Arsenic acts more gently, and is less liable to cause contamination. It is generally to be preferred to the use of organic matter, although it must be conceded that as crude a remedy as the use of an onion or potato often has the desired effect.

STONES

Any particles appearing in glass which are not vitrified are called stones. According to their origin they may be distinguished as batch stones, cap or crown stones and clay stones. Batch stones are usually white and analysis shows that they are high in silica. They are nearly always due to pieces of quartz which are introduced with the sand if the latter has not been sifted. In most cases the quartz is almost entirely vitrified. On account of the difference in chemical composition the light rays are reflected at angles different from the reflection of the surrounding glass. The result is a peculiar circular body, the center of which is opaque. Lack of heat and poor mixing of the batch are sometimes responsible for this condition. The remedy which suggests itself is careful sifting of the sand, and plenty of heat, which allows a thorough fusion of all materials composing the batch.

Pot stones or clay stones are parts of the pots or tank blocks. They are caused by the corrosive action of the molten glass on the clay work, which gradually breaks down. The particles, except those of small size, do not become vitrified. They are usually dark in color and analysis reveals a high content of alumina. Stones of this character appear oftener when salt cake glass is made than when soda ash is used, due to stronger chemical action of the former. Salt cake, moreover, requires a higher temperature which increases the power of attacking the clay.

Cap stones, or crown stones, are particles of silica bricks which fall down in the tank. The decaying of the bricks is due to fusion with deposited alkali and is apt to occur when batches rich in alkali are melted. These stones may be distinguished from batch stones by reason of the fact that they are usually larger and less vitrified. They are often surrounded by a number of small cracks, which radiate from the center and which apparently have fused together. The coefficient of expansion of high silica glass is smaller than

of common glass. On cooling, the glass surrounding the stone contracts more, causing cracks, and making the glass liable to breakage. For this reason clay stones cause only little damage in machine blown window glass, whereas the much smaller batch stones and cap stones are considerably more detrimental.

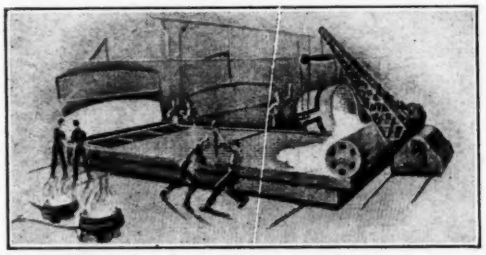
The problem of eliminating clay stones may be solved by constructing pots or tank blocks from a clay which deteriorates slowly and gradually. The small particles, on being worn off, are then entirely absorbed by the glass. The only other way which suggests itself is the development of a material which can withstand the action of molten glass better than clay, and which in no way contaminates the glass.

Progress Made in Plate Glass Manufacture

By J. W. CRUIKSHANK*

(*Written for* THE GLASS INDUSTRY)

This article is a brief sketch of the wonderful progress that has been made in the plate glass industry in recent years, but without any attempt to enter into a detailed description of the improvements, which is too wide a subject and with which those who are interested in reading this article will already be familiar, mention only being made of



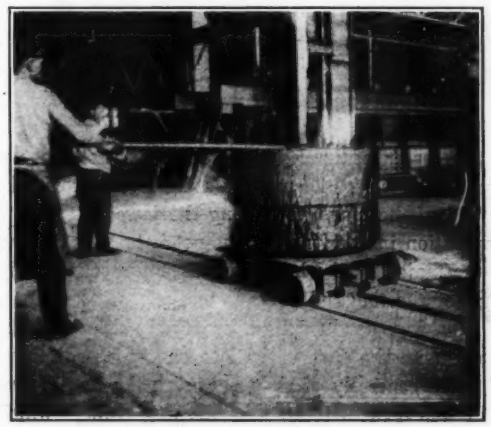
OLD MANUAL METHOD OF TEEMING PLATE GLASS

the processes and machinery for the purpose of comparing the old with the new.

The manufacture of plate glass as well as that of other processes for producing finished glass products depends largely on developed mechanical appliances. Before the age of invention and of perfected methods of producing accurate and reliable machinery, the industry of manufacturing glass was to a large extent dependent on the skill of the specialized workman, but in plate glass manufacture, where the process is largely mechanical, it may be said that the factory operations were mostly performed by the brute force of unskilled labor.

Today there are few branches of the glass industry in which the machine has not replaced the skilled workman and to a large extent reduced this labor of manipulation. In some industries, such as window glass and bottle manufacture, much product is still made by hand, but it is only a question of time before the machines now in use will supplant the workman in articles of standard manufacture. It may be said that this extensive employment of machinery has been the development of the last score of years, the latter part of which has been most productive of results. The window glass cylinder machine, the sheet glass drawing machine, the automatic bottle machine, and the mechanical manipulation of plate glass are all very recent developments.

With the exception of those who are directly connected with the various glass industries or who come in contact with them there is little real knowledge of these developments. Little has been written on the subject, a very scanty literature being available, most of which is so much out of date as to be useless except from an historic point of view. This the student can easily verify for himself if he wishes to look up the subject in any of the large technical libraries. I am now referring to the mechanical processes more especially to that of plate and sheet glass, and not to the very valuable papers recently published on the chemical composition and physical properties of glass. These have had their influence in the fields of optical glass and other glass of the better grades and are making available knowledge which can be applied to the elimination of furnace defects and to the working out of the annealing problem in other branches of the industry. These papers treating on the physical properties of glass are most interesting and present a tremendous field for investigation, as there is such an infinite variety in the results obtained from melting silica with fluxes that will produce glass of widely varying physical and optical properties, being transparent or opaque, hard or comparatively soft or even liquid at normal tem-



SKIMMING THE POT BEFORE TEEMING

perature, practically impervious to the attack of alkali or easily dulled on the surface by moist air.

The manufacture of plate glass relates more to mechanical processes and has little resemblance to the other branches of the glass industry except in the melting and annealing, which is fundamentally common to all. The basic processes in its manufacture are described by Chance under the head of

*J. W. Cruikshank Engineering Company.

"Crown and Sheet Glass" in "Principles of Glass Making" by Harris, published in 1883. This article describes the pouring of the glass on the casting table, the annealing in kilns and the grinding and polishing by machinery constructed for that purpose. Since then numerous improvements have as a matter of course been introduced, so that one not technically versed in the manufacture and seeing one operation after another would hardly recognize the two operations as being the same.

Prior to Chance, an interesting paper relating to the early state of the art is to be found in an article published in 1868 in the Proceedings of the Institute of Mechanical Engineers, entitled "Machinery for the Manufacture of Plate Glass" by Geo. H. Daglish, St. Helens, England, in which he states: "The process of annealing used formerly to occupy upwards of a fortnight, but from the improved arrangement and construction of the annealing ovens it is now completed in four days." This article gives the size of the sheets cast at St. Helens as 9½ x 17 ft., the production being twelve to fifteen hundred feet per week finished on the grinders.

Coming down to more recent times, an outline description of the manufacture of plate glass is to be found in the United States Census Bulletin published in 1902. This describes the first plate glass annealing lehr which was built by the Marsh Plate Glass Company at Walton, Pa., and mentions other lehrs that were running at that time. These lehrs were all of small size and only produced sheets averaging about 90 sq. ft. This really was the beginning of the extensive improvements that have since been developed in the plate glass industry. The introduction of the lehr revolutionized the method of casting, in that the casting table remains stationary in front of the first oven of the lehr, whereas with rows of annealing kilns which were constructed to hold from one to three plates, the table had to be moved from kiln to kiln so that the glass sheet could be pushed into the kiln after having been cast on the table.

The process of casting glass on a table in front of a kiln as practised before the year 1900 was one of the crudest that could be imagined. The pot was removed from the furnace by means of tongs some 20 feet long, mounted on wheels near the center of its length and known as a pot wagon. The pot was gripped by manipulating levers provided at the other end of the tongs, tightening the jaws on the pot. For this operation in carrying a large pot it took about seventeen men, the majority of whom were used for counterweight on the end of the tongs to balance the pot. The gang of men partly pushing, partly riding, conveyed this apparatus with its load down the furnace hall to one of the casting halls, which were generally at right angles to the line of furnaces. Here it was picked up by the "teeming crane," which consisted of a jib crane mounted on a track that ran down the casting hall back of the casting table. This crane was either pushed by hand or was propelled by means of a winch, mounted on the platform of the crane and connected by a chain to one of the axles, so that four men standing on the platform and turning the handles of the winch could move the crane to the proper position for casting. The pot was hanging by a chain from the jib of the crane, supported by tongs with long handles at each end, known as the teeming tongs. The "teeming" or casting was done by the men on the platform of the crane moving it with the pot transversely of the casting table and in front of the roller. At the same time four men, two of whom were stationed at each end of the tongs, at a signal from the casting hall foreman, who was generally one of the four, turned the pot over with a quick turn, at the same time swinging it in towards the roller, thus dumping and distributing the metal in front of the roller. It was a skillful operation and the statement was made more than once to the writer, in the days of this kind of teeming, that such an operation could never be done by machinery. The day of hand teeming has now gone by and the services of the man who now operates the mechanical teemer is now in the same demand as were those of his predecessor of former days.

After the glass was teemed the roller was started and pulled over it by means of a chain attached to each end of the roller, flattening the glass out into a sheet, the power

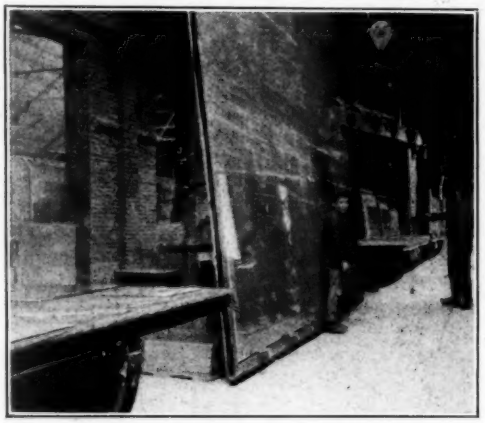


PLATE GLASS CUTTING TABLE TIPPED UP. A SHEET OF GLASS IS HANGING IN THE CARRYING CLAMPS WITH A MAN HOLDING EACH END OF SHEET

being furnished by men operating a winch. When the glass sheet was rolled, the roller passed off onto a carriage which stood between the casting table and the kiln which was heated ready to receive the glass. This carriage was pushed along into a position that would not interfere with a sheet of glass going into the oven. In order to bridge the gap between the table and the floor of the kiln an "apron" consisting of wood slats was laid across the space, one end resting on the floor of the oven and the other supported by the casting table. A tool was then brought up and placed in contact with the head end of the glass sheet, consisting of an iron bar which contacted with the glass, connected by rods to a light wooden cross beam which spanned the table. A man at each side of the table grasped this wooden handle; four or five others joining hands formed a line on each side of the table and started the glass sheet and pushed it into the oven. A second tool was then brought up which had an extension rod on it that pushed the glass still further into the kiln, and a third longer rod sent the sheet to the back of the kiln, leaving room for two others to be subsequently pushed in. The door of the kiln was then closed and the

glass sealed up for two to three days, when it was withdrawn. The withdrawing process was done by similar methods; a man crawled into the kiln and hitched a rope onto the back end of the glass. By means of this rope and a windlass the glass was pulled out onto a movable table, where it was cut for obvious defects. It was then picked up by the men and carried in a vertical position to the grinding shed, as many as sixteen men being used for the larger size plates, which would weigh 1,400 pounds each.

The present method of casting in an up-to-date plant such, for example, as the Allegheny Plate Glass Company,

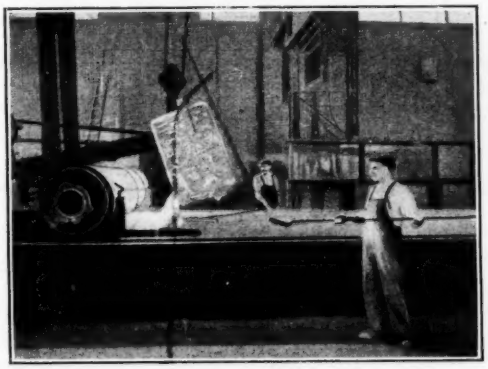


PLATE GLASS CASTING WITH MECHANICAL TEEMING CRANE
Designed and built by J. W. Cruikshank Engineering Co.

is certainly a great contrast to the old method as described. The pot is removed from the furnace by means of tongs carried by an overhead crane, from whence it is delivered to the mechanical teeming crane. Here one of the few hand operations takes place, namely, that of skimming the pot, which is performed by two men who remove impurities from the top of the glass by means of tools which they work round the pot and so remove this skim. The pot is clamped in the jaws of the teeming crane tongs by means of a screw operated by a workman. It is then carried to the opposite side of the casting table in a position for teeming. The teem is made by moving the crane forward on its overhead runway, and at the same time the contents of the pot are dumped out on the casting table in front of the roller. The roller is then started and rolls out the plastic glass by passing over it, and when at the end of the table next the lehr, it mounts on wedges placed on each side of the door of the lehr so that the glass can pass under the roller. The stowing tool is then put into operation and pushes the glass off the casting table into the first oven of the lehr. The tool and the roller return by mechanical means to their former positions. The whole of this operation is performed by one man stationed at the electric controllers which control the motors that perform the various operations as outlined. The glass passes from one to another of the five ovens, being moved by pushing tools which are operated by electric motors, and finally arrives in the sixth oven, at which point it is taken hold of by the rod conveyor of the lehr, which moves it down some 300 feet to the other end of the lehr runway in which the temperature is progressively reduced, the sheet coming out at the end cool and annealed. At this end of the lehr the sheet is pushed onto a car having electrically operated rollers to receive the glass. By this car it is conveyed to the cutting tables onto which the rollers, when put in operation, push the glass sheet. The cutting tables are equipped with small rollers below their surfaces, one set having their axes at right angles to the other and so arranged that either set can be raised by means of an air-operated cylinder. The glass can thus be easily pulled in either direction. This table can also be tipped into a vertical position so that the large sheets of glass can easily be handled and taken away by means of small clamps supported from an overhead crane, by which the glass is placed in the rough storage racks, ready for the grinders.

During this whole operation the greatest amount of labor employed at any one point is that at the cutting table, which necessarily takes a number of men to cut the sheet in a given time, remove the edges and handle the smaller pieces of glass that have been cut up. With this exception, labor has been reduced to a minimum, the operation being quiet and orderly with only a few men in evidence attending to their various duties.

In a recent paper on glass the statement is made that the plate glass industry has not experienced any spectacular developments in the nature of inventions, and that operations as carried out at present are fundamentally the same as those of Thevart in 1688, with, of course, modern furnaces and lehrs and mechanical appliances for handling the glass in the several operations. This, of course, may be essentially true as the fundamental process is the same, taking as a basis that the glass is melted, cast, rolled, annealed, cut

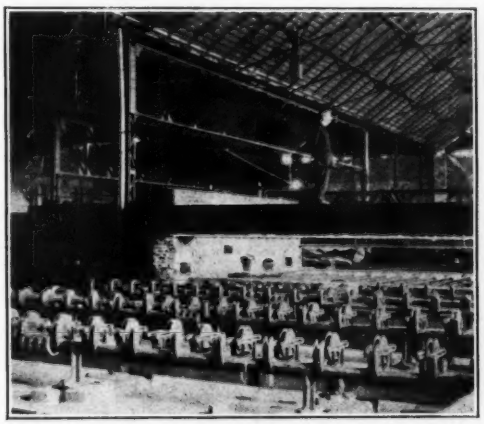


PLATE GLASS ANNEALING LEHR IN PROCESS OF CONSTRUCTION
J. W. Cruikshank Engineering Co.

and ground and polished. However, it cannot be gainsaid that there has been considerable invention and progress made towards perfecting the art.

Numerous attempts have been made from time to time to revolutionize the industry in a spectacular way. For example, in the factory mentioned above, built by the Marsh Plate Glass Company, where the first plate glass lehr was built, the glass was cast in small sheets about 50 sq. ft. in area, from which it was taken to rectangular grinding tables of exactly the same size as the glass sheets, thence to polishers of the same size which were provided with vacuum chambers

with holes through the surface of the table by which means the glass was held down while being polished, in place of using the old-fashioned plaster of Paris which is still in use. These polishing tables also had hollow chambers which were heated by steam, warming the glass so that it would polish quickly. It will readily be seen that not only was this apparatus complicated, but that the glass would not stay the same size and sometimes would break, thus rendering useless the arrangements provided for it. This plant was bought by the Pittsburgh Plate Glass Company, who, after considerable experimenting, finally abandoned the whole operation.

There is a long standing idea that plate glass manufacture would be revolutionized by the introduction of the continuous melting tank with an arrangement by which the glass could be delivered in front of the casting roller on the table and then rolled. This would undoubtedly be a great improvement as it would eliminate the expense of the glass pot, with economy of fuel for melting, as well as other advantages in the handling of the raw material, space in the factory and resulting compactness of operation. The objection to introducing such a system is, in the first place, the mechanical difficulty of placing the glass in front of the casting roller without causing bubbles and other defects. An operation has already been tried on a small scale in which the glass was flowed into pots which were set on a revolving table in an annex to the furnace and after being filled with glass from the body of melted metal were taken out and cast. The glass, however, was so full of defects that this experiment had to be abandoned. Another question is as to whether a good enough quality of glass for plate glass can be melted in a continuous tank, although the metal produced by the first-class window glass manufacturers would seem to indicate that this is possible. However, the first cost of an installation of a plant where the glass would be melted in a tank is a deterrent to putting any such process into effect, even should there be a practical means for delivering the glass to the casting table, which does not seem to exist at the present time. Should this method of manufacture be accomplished and prove successful, the actual saving in the cost of manufacture would not be such as might be supposed by those who are not conversant with the industry. The actual reduction in cost would not amount to more than a small percentage of the total cost of polished plate glass put in stock, assuming that the casting was reduced by a considerable fraction, the elimination of the pot being the principal item of saving.

The limits of this paper will not permit the discussion of all the schemes that have been put on paper and some of them actually tried for revolutionizing the plate glass industry. One of them might, however, be mentioned, which was experimented on in a small scale at Kittanning, Pa., and for which the buildings for a factory were afterward put up on an extensive scale at East Brady, Pa., which, however, went no further, the improvement in this case being in the grinding. A sheet of glass was clamped in a frame set vertically and reciprocating runners were mounted on each side of the glass by which it was to be ground on both sides at once. There are various patents on these lines which contemplate the grinding of glass on both sides at once, and even a number of glass sheets set vertically in contact with each other so that with relative motion they would grind each other. It is evident that the breakage alone in an article that does not have the properties of metal will prevent any process of this kind being put into successful operation.

Wonderful strides have been made in the grinding and polishing departments in plate glass factories. Some fifteen years ago the grinding operation took four to five hours and the polishing an equivalent time. Now both of these operations are done in some plants in less than an hour. This is partly due to the flatter glass produced in the lehr and partly to the improved machines for grinding and polishing. There is no comparison between the grinding machine of today and that of twenty years ago, the modern machines being of rigid construction so that they do not deflect a thirty-second of an inch, instead of being flimsy and flexible like the old machinery. The special advantage in having a stiff machine is that much time was wasted in former years in running the grinder at a very slow speed to avoid breakage in reducing the lumps on the surface of the glass. The practice today is to start at full or nearly full speed, running at the slower speed for only a short time. The lowering of the runners very gradually onto the surface of the glass to first grind off the high spots, is made possible with rigid and true machinery.

It is evident that great progress has been made as outlined in this paper and it may be said in conclusion that much enterprise has been shown on the part of the American manufacturers in adopting new methods and devices when they are shown to be of value.

Wax Coating for Tableware*

A Preparation for Protection During the Etching Process

The following recipes have been found satisfactory:

	I.	II.	III.
Oil of Turpentine.....	120	400	100
Asphalt	80	100	25
Tallow	20	5	7½
Stearin	20	40	...
Beeswax	30	30	...
Resin	40	20	12½
Turpentine	...	...	15

In an open pot, melt together the asphalt and the oil of turpentine. This may take considerable time. The pot should not be more than half full and should be protected from the open flame. Add the other materials in the order mentioned and stir with a stick until the components are dissolved. Allow to cool and pour through a 120 mesh sieve into a jar, which is kept standing in cold water to hasten the cooling. Stir until cold and keep well covered to prevent the oil of turpentine from thickening.

Black Glass

A special use for manganese ore in glass making, in addition to its use as a decolorizer, has developed in the last few years, namely, for producing black glass used for ornamental purposes. About 3 per cent of ore is added to the batch in making this opaque glass.—*Bureau of Mines.*

* *Sprechsaal*, 1916, 49, 287.

The Manufacture of Mother-of-Pearl Glass*

Translated for THE GLASS INDUSTRY

By HARRISON W. CRAVER

Efforts to produce a glass resembling mother-of-pearl extend back to the earliest beginnings of the industry. But although recipes of various kinds have been given,—among others, by Johann Kunckel in his work on the art of glass making (Nuremberg, 1756)—the attainment of results that are really tangible and worthy of consideration in this field has been left for the technologists of the present day. What Kunckel and other technologists of the past taught us to know of the matter, were only facts concerning the decorative treatment of glass with pearl colors. To the special formal composition of the glass mixture, their communications make no reference, and the researches on the imitation of mother-of-pearl with glass which were instituted on such a comprehensive scale by the Venetian glass makers were unsuccessful. It is true that the pearl-like ornaments made later of glass and other raw materials with pearl essence, by the Frenchman Jacquin, in accordance with Reaumur's instructions, gave a more definite direction to the previous attempts and researches, but they were satisfied then with superficial decoration; and when finally in 1870 the first iridescent glass appeared, the researches that had in the meanwhile been always recurring appeared finally to be abandoned entirely.

However, the manifold, often absolutely astonishing successes of the imitation industry have again stimulated glass makers, during the past decade, to manufacture a kind of mother-of-pearl from glass. These newer experiments depend upon a glass that, so to speak, already contains the basic principles, and there is used a special composition producing a bright semi-opaque alabaster glass, which approximately corresponds in composition to the following mixture:

Sand	100	parts by weight
Potash	45	" " "
Red lead	52	" " "
Bone ash	8	" " "

Frequently 4 parts of potassium nitrate and 8 to 9 parts of ignited guano are preferred to the lead oxide, in order to obtain a more intense cloudiness. Little flasks that have been colored by cooling and repeated heating are flashed with a semi-crystal glass, and it is thus possible to obtain an opalescent color effect in the glass, resembling mother-of-pearl.

The beginning was made in this way; it now became natural to strive to achieve the method on a usable basis. Especially, in order to imitate the well known antique mother-of-pearl glass of the Venetian variety, a small percentage of manganese was introduced, to obtain a weak tinting of the material. This led to the following change in the batch:

Sand	145	parts by weight
Red lead	20	" " "
Lime	18	" " "
Soda	40	" " "
Manganese	0.50	" " "

The result was that flaws could always be seen in glass of this character after flashing, if a glass of unequal expansion were used. Especially, the ground glass failed easily and showed numerous cracks. In order to remedy this difficulty efforts were first directed toward obtaining equality of expansion in the ground glass and the flashing glass. Simultaneously, however, an effort was made to obtain the iridescent luster characteristic of mother-of-pearl. The method suggested by Benoni, of using mica to obtain a brocaded effect, which, as is well known, was also used as long ago as 1847, by Weiskopf and Berut, for certain kinds of brocade glass, has recently been given consideration, especially since Parkert has simultaneously called attention to the effect of mica. Experiments have also been made with a new glass batch, which is frequently described as an easily fusible lead glass, but is not so in a proper sense. This is composed of:

Sand	100	parts by weight
Soda	12	" " "
Red lead	33	" " "
Potash	20	" " "
Saltpeter	4	" " "
Manganese	0.65	" " "

Metal salts are used for tinting this to the various tones; for example, copper oxide and uranium yellow for a greenish yellow, uranium yellow for bright yellow and pure cobalt oxide for blue. An effort has also been made to increase the mother-of-pearl effect by the use of special molds before blowing.

In Bohemia there is used for the ground glass a mixture of:

Sand	40	parts by weight
Red lead	40	" " "
Potassium carbonate	10	" " "
Potassium chloride	0.25	" " "
Sodium nitrate	5	" " "
Arsenic	0.5	" " "
Calcium phosphate or bone-ash	1.25	" " "

The materials which produce the mother-of-pearl luster in this case are the potassium chloride and the calcium phosphate.

In America, opalescent or opaline glass is used to imitate mother-of-pearl. It is not essentially different in composition from the glass batches already described. Usually it consists of:

Sand	100	parts by weight
Soda	35	" " "
Fluorspar	22	" " "
Feldspar	40	" " "
Red lead	5	" " "
Soda saltpeter	5	" " "

or, while retaining these amounts of sand and soda, 40 parts by weight of fluorspar and 20 parts of barium carbonate are taken. German opaline glass, in comparison, has the following composition:

Sand	68	parts by weight
Potash	21	" " "
Soda	5	" " "
Red lead	5	" " "
Saltpeter	1	" " "
Borax	1	" " "
Calc-spar	4	" " "
Bone ash	6-10	" " "

Nickel oxide or manganese oxide is used as a coloring matter. The best material for making the glass opaque, without burning out, is cryolite or bone ash, to which some zinc white

*O. Schwarzbach in *Sprechsaal*, v. 53, p. 251, June 10, 1920.

may perhaps be added to increase the opacity. Cryolite may also be replaced by feldspar, kaolin or fluorspar. It should be noted, however, and it deserves special attention in the working of the glass, that opal glasses which have been made opaque by fluoride lose in intensity of color upon frequent heating. If very fine mica dust is pressed on such a glass mixture after it is taken from the pot, or if mica, in the finest form, is introduced into the first flashing layer and a second flashing coat of crystal glass is given, lustrous color effects similar to real mother-of-pearl are successfully attained. Technical skill and dexterity are necessary, of course, for successful results.

In order to brighten the effect, the glasses are either repeatedly exposed, in retorts, to a strong reducing flame and subsequently iridized, or a similar effect is produced on the finished ware by lustrous or iridescent colors.

Silent Spokesmen in the Factory*

By ROSCOE SCOTT†

While we engineers are improving the efficiency of machinery and mechanical equipment of all kinds, we shall do well to recognize the importance of promoting mutual understanding and goodwill with the people in our plants—the human element on whom we depend for the translation of engineering into commercial output.

Many employers have had the notion that good wages, good hours, good treatment and good working conditions—important as they unquestionably are—would solve every difficulty with labor, and have been disappointed to find that all of these helps combined did not produce the immediate results expected. They did not create a "company feeling," nor did they deter employees from throwing up their jobs with disturbing frequency.

The company may spend $20,000 on a special ventilating and air-conditioning system, to eliminate unpleasant working conditions in certain departments, but does Sally Smith give the fact a moment's thought before taking it into her head to "lay off a few weeks"? Perhaps she does; perhaps she considers the efforts that have been made in her behalf and decides that she, in turn, should do the square thing by her employer. But if she does thus take the company's efforts into account, it is probably because she has been *told about them, and from time to time reminded of them.*

Only a constant presentation of the facts in their proper light can keep even the most intelligent of us from occasionally viewing our work through colored spectacles that distort the good and make mountains out of mole-hills. In the case of an operator at the bench or machine, who has formed the mental habit of looking at his work as meaningless and at the quitting-time whistle as his best friend, we should not blame him for the human tendency to overlook shower-baths, bonuses and other benefits, but should, rather, blame ourselves for not having tried to direct his thoughts along the proper lines. How, then, shall this be done?

First and foremost, the personal contact of the superintendent with his foremen, and through them with his people, can do wonders towards promoting an atmosphere of harmony and co-operation, if systematic effort along this line is made. But there are limits to what can be done by personal contact. Some foremen are ill adapted to explain the company's policies to employees; others are too busy, or take no interest in that sort of thing. Right here is where the "Silent Spokesmen in the Factory," referred to in the title of this article, play their part.

The "spokesmen" in question consist of printed messages, systematically posted throughout the plant, reminding the people of facts they would otherwise overlook, and in this way molding their attitude towards the institution with which they are connected.

In the incandescent-lamp factories and lamp-parts factories of the Edison and of the National Lamp Works of the General Electric Company, "silent spokesmen" have been put to work to build up goodwill among some 15,000 employees. A three-fold system of placarding was started over two years ago, comprising:

(1) Permanent signs, 15 in. by 11 in., protected by glass in green wooden frames.

(2) Smaller placards 11 in. by 8½ in., protected by celluloid in slotted frames. These placards are changed at six-week intervals, the plan being to put up new copy before the old copy has entirely lost its interest.

(3) 5½ in. by 3½ in. cards (postcard size), distributed in large numbers in suitable holders of three specially-designed types, throughout the factory. These cards also are changed at six-week intervals.

The purpose of the large permanent signs is to advertise certain definite working conditions, or beneficial features of the plant, to those who benefit by them. One sign, for example, reads:

> "HEALTH = $$$$$$
>
> "Your health is priceless.
>
> "You value it—we value it, too.
>
> "We value it so much that we have put in a special ventilating plant, costing many thousand dollars, to change the air in here completely every few minutes and prepare it for your lungs. The air is purified, then moistened so as not to be harmfully dry, heated or cooled (as needed), and forced into this room by a powerful fan.
>
> "No poor air conditions for our people—not if the management can help it!"

Among other points similarly featured are pure drinking water, large windows, fireproof doors, "panic" doors, oily-waste cans, clothing lockers, protective conduits for electric wires, toilet-room facilities, fire extinguishers, sand and water pails, and guards on machinery. The simple facts are stated, and the reader left to draw his own conclusions.

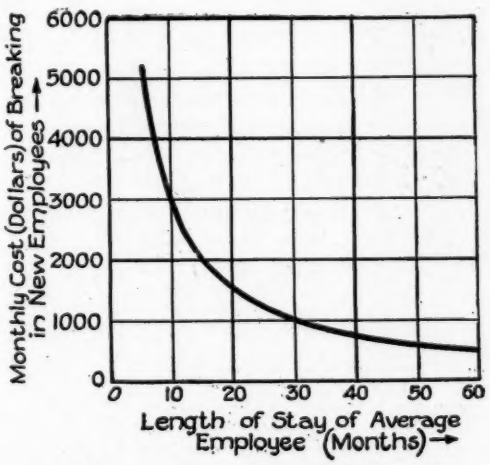
*General Electric Review, Vol. XXIII, No. 3 (March, 1920).
†National Lamp Works of General Electric Company.

The 11-in. by 8½-in. changeable placards carry goodwill messages suited to special seasons of the year, or deal with special conditions that may arise, such as an epidemic of tardiness (these frames, by the way, are located near the time-clocks and building entrances). It is felt that the requirements of promptness and regularity can be presented in such a way as to create goodwill. Among the seasonable placards posted are those relating to Christmas, vacations, lectures at the factory, precautions against influenza, etc.

The small cards (5½ in. by 3½ in.) are more general in tone. The goodwill messages which they bear relate not only to the employee's work, but to the spirit of the institution; sometimes epigrams and quotations regarding qualities that foster or hinder success are given.

"Do they pay?" is a question that naturally suggests itself regarding the "silent spokesmen in the factory." The answer, viewing the matter from either the theoretical or the practical standpoint, is "Yes." The accompanying diagram, indicating the great saving of expense in "breaking in" new employees, through lengthening the average term of employment, shows one reason why it pays. A numerical example will show even more clearly what is meant.

Assume that the average cost of "breaking in" a new employee is $100, which is a conservative figure in many industries when all factors are taken into consideration. In a shop containing 300 employees, whose average length of



EXPENSE OF TRAINING NEW EMPLOYEES

stay is 10 months (which is a typical condition in industries where female operators are in the majority), the monthly cost of "breaking in" new operators will be $3,000. A little figuring will show that on any plan which will increase the average period of service by even 2 per cent, the management will be justified in spending $58 per month. The cost of the placarding system, when conducted on a large scale and spread over a large number of factories, is much less than this.

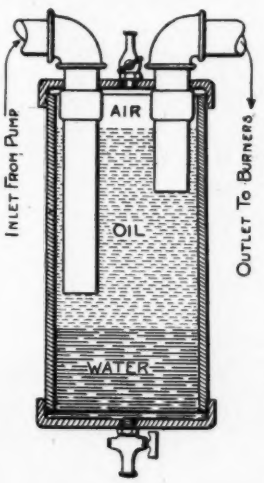
A test of this advertising service was made in a certain department employing over 100 male (union) operatives, with the object of reducing, if possible, the number of unexplained absences from work. The following month showed a drop of over 25 per cent in the percentage of absences.

From a Cullet Wheeler's Note Book

By Dick Lee

An Air, Oil and Water Separator

One objection, often cited by glass manufacturers who have not had much experience in the control of oil as a fuel for tanks and lehrs, is the "popping" or "puffing" flame that is sometimes encountered. This seems to be due to the oil not flowing steadily to the burner, caused by an unsatisfactory condition of the pumping outfit. In some way water or air is introduced into the oil line. When these small particles of air or water reach the burner, they temporarily shut off the flame. Air passes through an opening much more rapidly than oil. For this reason, the velocity of flow of the oil is increased in the pipe so that a heavy spurt of oil is forced through the burner into the tank, or lehr, giving a large puff of flame. This condition gives an unsteady flame and produces an unnecessary amount of smoke.



This trouble can be remedied by a perfectly air-tight pipe line on the suction side of the pump. Air usually enters through leaky fittings. A tight packing around the rod of the pistons of a double-acting pump will keep air from entering at this point. "Air in the oil line" is felt more when the pump discharges directly into the pipe line of the burners. If the oil, after leaving the pump, enters a temporary or daily storage tank, a pet-cock placed at the top of the tank will permit the escape of any air that accumulates. This pet-cock also acts as a guide to indicate when the tank is full.

Some of the lower grades of oil contain considerable water. Sometimes a leaking steam coil in the tank car puts water with the oil. Water always separates from oil after a short time and settles to the bottom of the tank. The suction line of any pump drawing from the bottom of the tank will pick up a large part of this water. To prevent this water from flowing to the burners, a pet-cock should be placed at the bottom of the temporary or daily storage tank. Then, all accumulations can be occasionally drawn off.

It may be that you do not have a tank or reservoir between your oil pump and the burners. Air and water in the oil pipe line can be overcome by a very simple apparatus. The illustration explains just how this can be accomplished. This is made from one piece of ten-inch pipe, the larger the better, and two caps. The oil passing from the pump into the separator forces the oil to rise at a decreased velocity. This gives the water time to separate and settle to the bottom of the separator. Also, the air bubbles will rise to the top of the separator. Both the air and water can be removed at regular intervals through the pet-cocks at the top and bottom of the separator.

English and American Glass Industries Discussed by a Prominent Authority

In view of the visit to the United States a few months ago of Professor W. E. S. Turner, of the School of Glass Technology, University of Sheffield, England, accompanied by a party of members of the Society of Glass Technology, who made an extensive tour of the glass-making districts of the country, the following article from the *Pottery and Glass Record* setting forth Professor Turner's conclusions, arrived at after personally investigating American methods, will prove of interest to American glass men and is therefore reproduced in full.—EDITOR.

The Glass Industry in England and the United States*

SOME INTERESTING COMPARISONS

The Views of Professor W. E. S. TURNER, D.Sc., M.Sc.

As a teacher and a scientific investigator, the first point raised was naturally in regard to teaching and research work in connection with glass technology in teaching institutions. Comparatively little systematic research on this subject is carried out by any university or similar institution in the United States. There is as yet no Department of Glass Technology attached to any university in the world, except that of our own here in Sheffield. There is a little teaching work done in connection with glass in one or two centers, namely, at Pittsburgh, at Columbus, Ohio, and at Urbana, Illinois; but the instruction is rather of a general than special character. So far as his time permits, a little research is undertaken by Professor Silverman, head of the Chemistry Department in the University of Pittsburgh. He has already done very useful work indeed. Professor Washburn, of the School of Ceramic Engineering, Urbana, is also devoting time to glass research, but, as previously remarked, there is no teaching institution which sets out to give itself to teaching and research in glass technology alone. The famous Mellon Institution in Pittsburgh undertakes research work in all branches of applied chemistry, and Dr. E. Ward Tillotson, Assistant Director of that Institution, is well known as an authority on glass. The researches, however, which that institution is called on to carry out in glass are only occasional, and not systematic. There is a feeling in the States that it is time there was set up a teaching institution especially devoted to the glass industry.

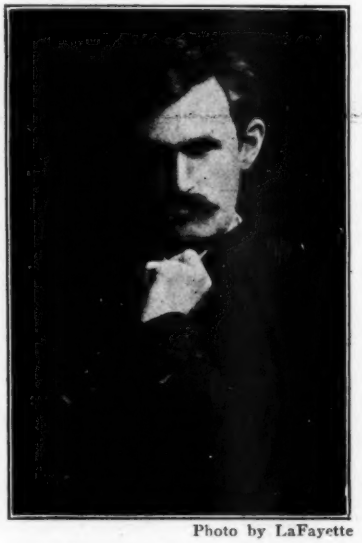


Photo by LaFayette
PROFESSOR W. E. S. TURNER

Asked as to whether Government assistance has been given to workers in glass research, as is the case in this country, Dr. Turner stated that "in the last three or four years the Government of the United States has given very great assistance indeed. In the last two years there has been built at the Bureau of Standards, Washington, a department called the Department of Industries and Commerce, and part of the building is being devoted to research in clay products and glass. A considerable amount of research on optical glassmaking has taken place, as also in connection with the production of satisfactory glass pots. Further, the branch of the Bureau of Standards in Pittsburgh did a very great deal of work also in connection with glass pot making and optical glass. Again, the Geophysical Laboratory, Washington, sent out practically all of its research staff, many of them with a considerable reputation, to enter glass works during the war, and assist especially in the production of optical glass.

As to whether much work in pure and industrial research was being carried out in the factory laboratories, and particularly what its effect is in strengthening the position of the United States in illuminating glassware for export trade, Dr. Turner gave a characteristically frank reply. "Quite apart from Government efforts, a large number of scientific workers are engaged in research and industrial establishments. For example, at the Corning Glass Works, there is a scientific staff of more than twenty, whilst at the General Electric Company a large staff is also engaged on problems connected with glass and illumination. Some of the results of these efforts have been very striking, and there is an indication that unless in this country greater effort is put into research on glass technology, America will be leading the way with a very pronounced start. Nevertheless, there is not the slightest doubt that we in this country could make advances at least as notable as those either in America or elsewhere, if manufacturers could be persuaded more and more to realize its value not only for the present, but also for the future.

"It is difficult to distinguish between pure and industrial research work. The General Electric Company, for example, at Cleveland, keep quite a considerable staff of scientific workers who are engaged on problems which would appear at first sight to have but a remote connection with any industrial application. The firm, however, considers that it is well to encourage so-called pure research since the fundamental facts must be multiplied before any conceivable application or any real advances in applied science are possible."

On the point as to whether more and better research in refractories and the chemical and physical properties of glass, was being carried on in the United States laboratories than in this country, particularly in regard to practical manufacturing, Professor Turner expressed himself as follows:

*The *Pottery and Glass Record*, December 15, 1920.

"Undoubtedly, more research is being carried on in the United States in industrial establishments, both on refractory materials and the properties of glass, than in England. I may, for example, refer in the case of refractories to the pot with a partly porcelain body which was devised by Bleininger to assist in optical glass manufacture. Then, also, to mention two instances, the manufacture of ruby selenium glass has at least in one factory reached a high stage. My next illustration is the development of the so-called daylight lamp for giving light approaching daylight, and making it possible to match shades in shops where, with the ordinary forms of illumination, matching is difficult.

"I would like to say this, however, despite the attention which has been given by so many workers in the States to the production of optical glass, I still think that the progress made by at least one firm in this country in optical glass during the war period only, is far away ahead of anything which has been done elsewhere outside of this island. It is certain that with a similar effort in other branches we could make rapid progress."

Asked if the limitations in this country are due rather to the lack of scientific education in our schools than lack of interest in scientific application of results on the part of workers in glass, Dr. Turner replied: "I do not think that the fault in this country lies in the lack of scientific education in our schools as compared with America. It is true, however, that until there is a higher standard of education all round it is difficult both for the public, which does have an influence in the matter, and the general body of manufacturers, to appreciate what science can do and what it cannot do."

Of the value of mechanical aids for increasing and facilitating production, Dr. Turner stated: "I certainly think that a good deal might be done towards providing some mechanical aids in the workshop to speed up the production even of the most artistic types of glass. Very little has been done for centuries to improve on the methods of handling glass in artistic glass factories. I cannot help but think that whilst the development of the lathe has reached such a high level, that something could be done to apply the development to the turning of glass when an article is being fashioned, instead of having to depend on the workman rolling his iron up and down on the old-fashioned chair."

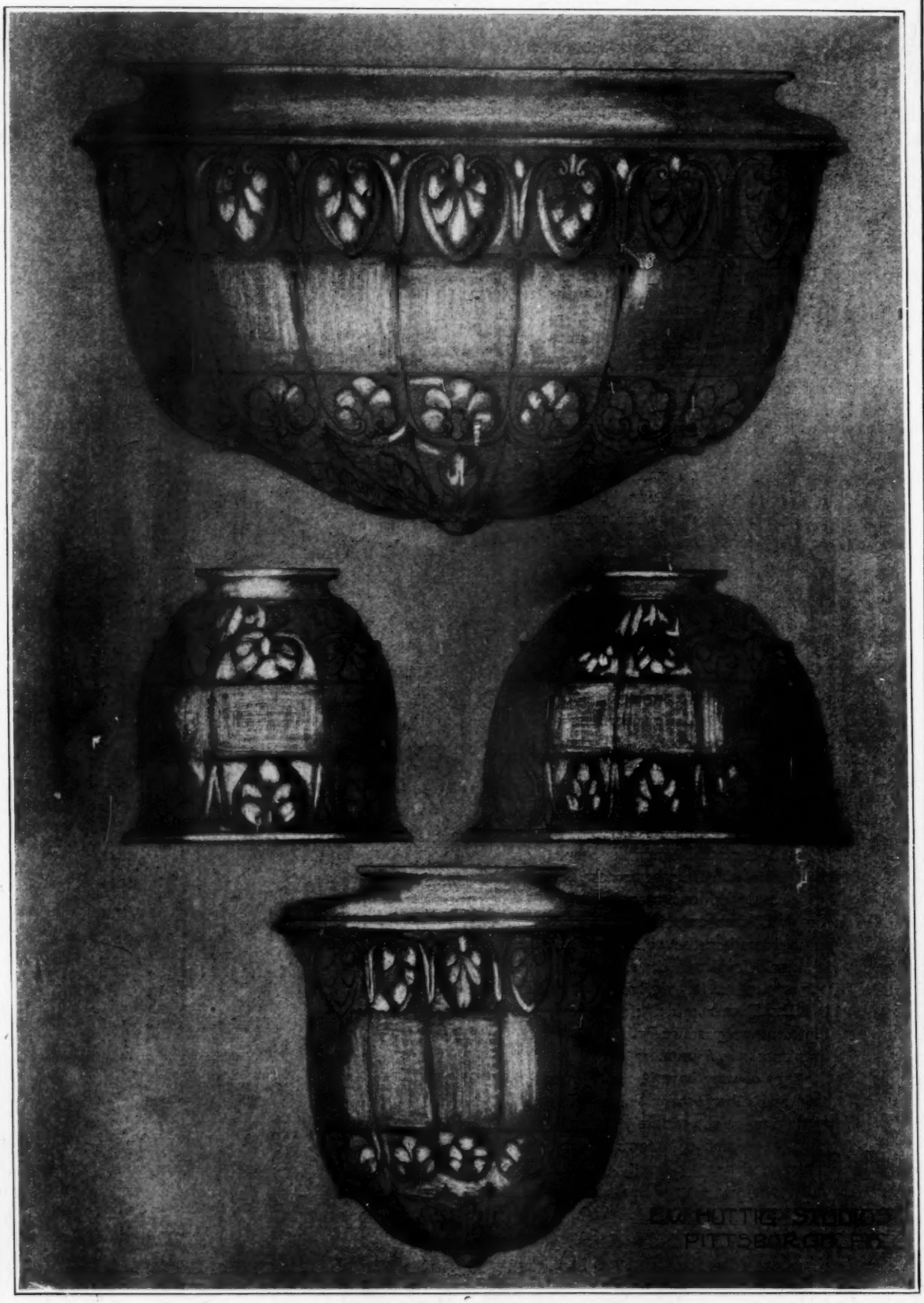
As to the comparative merits of British and American artistic glassware, Dr. Turner said: "In general, I am of opinion that at present we produce artistic glassware of a higher type than America. A number of factories in the States making this type of ware have been developed through the use of British and other foreign labor. There is one way in which production might certainly be improved, and here I merely give the opinion of a former British worker, who left this country, and went to America some years ago. He stated that he was with a firm which bought its blanks for cutting purposes in England, and after they had been cut and decorated, the finished goods again found a market in the old country. It was his view that limitation of output, such as had previously been practiced in this country, made it possible for other countries to do as the firm he was engaged with had done. Further, he said that some parts of the work even in glass cutting, were either of an unskilled or semi-skilled character, and he pointed out that it was a waste of time for the expert glass cutter to spend his labor on them. In America, he said, the glass cutter would have one or two girls as assistants, who would carry out some of the less skilled operations, and pass on the article for finishing to the expert cutter in the last stages."

Replying to a question regarding co-operation between manufacturers and purchasers, and the limitation of sizes in the bottle and jar and container trade, Dr. Turner said: "I cannot say to what extent this co-operation exists in the United States. Undoubtedly, however, it is a fact that specialization and standardization are necessary factors in the success of American bottle and jar manufacturers. Machinery has entered in the last ten years into the bottle and jar producing factories to the exclusion of hand labor. The production by the aid of such machinery is on an enormous scale, and such immense production is only possible where specialization occurs, and a limited number of sizes and shapes are manufactured. A machine on which the molds have continually to be changed is not economical. Indeed, American manufacturers are disinclined to make an article at all unless they can make it in large quantities. Overhead expense is thereby saved. Moreover, the designing of the machines and all other plant, such, for example, as the annealing lehrs, is simplified when only a very few types of articles are made at the works, and any one of those types may be produced for quite a considerable period of working time.

"In regard to standardization in this country, I feel sure that manufacturers will inevitably be driven to it. Some manufacturers are already endeavoring to work on American lines. Those who still adhere to the old method of making a very large variety of bottles in comparatively small quantities will, I fear, ultimately be squeezed out of the industry. It may interest some of your readers to know that one of the sub-committees of the Committee on Glass and Glassware Standards, set up by the Society of Glass Technology, deals with the question of standard sizes and shapes. A certain amount has been done by this committee, but its labors are far from being completed. We have not received from the general body of manufacturers the data, opinions and information which we have sought for, and this has retarded our considerations. I feel sure, however, that standardization will have to come."

Fuel Control in German Glass Industry

The Association of German Glass Manufacturers has established the "Waermetechnische Beratungsstelle der deutschen Glasindustrie" (Heat Economy Advisory Bureau of the German Glass Industry) with headquarters at Frankfurt. The salient factors in the program of the bureau, which will act in an advisory capacity only, will be a close investigation and valuation of available kinds of fuel and recommendations as to their appropriate distribution and exploitation, reconstruction and adaption of existing plants to inferior fuel, *e. g.* lignite, coking of coal, selection of suitable ovens, instruction and information in the matter of heat measurements and research methods, etc.



DESIGNS FOR ILLUMINATING GLASSWARE
An Example Illustrating the Present Tendency in Decorative Effects
Prepared for THE GLASS INDUSTRY *by* E. W. HUTTIG

The Laboratory

By J. B. KRAK

The importance of technical control in the glass industry is being more and more understood by manufacturers who produce the bulk of the nation's glass supply. With the decline of the purchasing power of the country at large the problem before every manager today is lower cost and greater production. What technical control has accomplished for the cement, the steel and the paper industries can be done for glass manufacturing. The fact has been strikingly demonstrated in the production of optical glass and chemical glassware, and needs only wider application. It is the hearty desire of THE GLASS INDUSTRY to further in every way the co-operation of manufacturing experience and applied science of the glass maker and the chemical engineer. It is believed that a discussion of the methods by which adequate control can be exercised will prove of interest to our readers. In this, and the following issues, some control procedures will be presented. It is hoped that they may provoke discussions and that suggestions will be made tending to improve the methods, so that in the end they may become standardized and generally accepted.

The methods to be presented fall under the following headings:

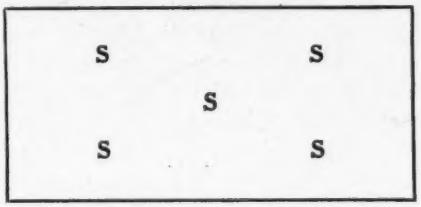
1. Analysis of raw materials, batches and glasses.
2. Analysis of refractories.
3. Analysis of solid, liquid and gaseous fuels.
4. Miscellaneous control procedures.

It is evident that only general outlines can be given, and that it is beyond the scope of these articles to enter into a description of all the details involved. For complete directions the chemist is referred to standard works on quantitative analysis. It may not be out of place, however, to discuss more fully those analytical procedures which, while not in general use, are especially applicable to problems in glass chemistry.

Sampling

Care in taking a sample is of even greater importance than skill and accuracy on the part of the analyst. If the sample does not truly represent the average composition of the material to be tested, the chemist's efforts are of no avail. The raw materials of the glass industry are usually delivered in a finely divided state, so that crushing is unnecessary, thus obviating one of the most disagreeable operations in sampling.

CAR SAMPLING.—The surest way of keeping track of the quality of raw materials is by taking samples from each carload, before transferring to the storage bins. Remove about ten inches of material at the surface at each spot where a sample will be taken, and collect five pounds at five places, indicated in the accompanying sketch. Mix the samples carefully on a clean, concrete floor and spread the material out in a circle, about four inches in thickness. Divide in four equal quarters, discard two opposing sections and mix the remaining two. Repeat the operation until about two pounds remain, representing the carload. Reduce this sample to a fine powder and quarter down to about one pound, which should be transferred to a glass stoppered bottle and sent to the laboratory.



BIN SAMPLING.—It is difficult to give instructions for sampling the contents of a storage bin. The principle to be kept in mind is that material must be taken in a sufficient number of places and in proper quantities to fairly represent the average composition of the bin contents. It should be ascertained if the bin has been filled in layers or in different heaps, and the sampler should exercise judgment as to where sampling places should be selected.

Technical Analyses of Sand

This procedure is based on the volatilization of the silica as silicon tetrafluoride and analysis of the residue.

Transfer a 5 gram sample to a platinum crucible of about 50 cc. capacity, add a few drops of sulphuric acid and about 40 cc. of hydrofluoric acid. Evaporate on a steam bath until odorless and repeat the treatment. Heat on a hot plate until fumes of sulphur trioxide cease to be evolved. Fuse the residue with sodium carbonate, dissolve in hydrochloric acid, evaporate to dryness and filter. The iron, aluminum, calcium and magnesium of the sand are contained in the filtrate.

To this solution add ammonium chloride, heat to boiling and precipitate iron and aluminum as hydroxides. Filter and weigh as combined oxides.

To the filtrate add ammonium oxalate solution and determine the calcium as calcium oxide. Concentrate the filtrate from the calcium oxalate precipitate, make acid and add a solution of microcosmic salt. Add ammonia until alkaline to litmus, and after 15 minutes add ammonia in excess. Filter and weigh as magnesium pyrophosphate.

Estimation of moisture and ignition loss. Weigh a one-gram sample in a tared platinum crucible, dry at 105° C. for one hour and weigh. The loss in weight is reported as moisture. Heat the crucible over a blast lamp for 15 minutes and weigh. The loss in weight represents loss on ignition.

The most important impurity in sand is iron. Of the many procedures to estimate this element, after weighing it with alumina as combined oxides, the following method has proved to be the most accurate and rapid.

The estimation is based on the fact that ferric chloride reacts with hydroiodic acid.

$$2\ Fe\ Cl_3 + 2\ H\ I = 2\ H\ Cl + Fe\ Cl_2 + I_2$$

The reaction is reversible and requires a large excess of hydroiodic acid to be quantitative. The liberated iodine is titrated with N/20 sodium thiosulphate solution, which is standardized against a solution of ferric chloride of known strength, using the same procedure.

To apply the method to the analyses of sand fuse the oxides of iron and aluminum with sodium carbonate and dissolve in hydrochloric acid. Transfer the solution to a glass stoppered bottle, displace the air with carbon dioxide and add five grams of potassium iodide. Replace the stopper and after 20 minutes titrate the iodine with standard sodium thiosulphate solution, using starch sodium as indicator. Calculate the results to ferric oxide and deduct from the weight of the combined oxides. The difference is the alumina.

Add together the percentage of ferric oxide, alumina, calcium oxide, magnesium oxide, moisture and loss on ignition. Deduct the sum from 100 and call the difference silica.

The percentages of moisture and loss on ignition are of importance in the calculation of the batch composition. For the purpose of comparing glass sands it is advisable to calculate the results on the ignited basis.

The method described above is sufficiently accurate as a technical control procedure and is applicable in the majority of cases.

Manganese Ores in Glass Making*

Practically all the raw materials used in glass contain some iron, usually in the form of ferric oxide. The iron, when present even in small quantity, imparts to the glass a pale green color that increases rapidly in intensity as the iron content increases. If a colorless glass is desired, this green color must be removed by some decolorizer. Manganese, selenium, cobalt, and nickel are the most common decolorizers in use, and of these manganese has been most widely employed because it permits easy control of the color. In using selenium and nickel, the quantity must be carefully controlled, but these latter substances are desirable, especially in window and plate glass, because glass decolorized with manganese often changes to a pink color on exposure to the light. A decreasing quantity of manganese is being used by makers of tank glass, and its place is being taken by selenium.

The quantity of manganese used varies considerably, depending on the character of the glass, the method of its manufacture, the iron content of the raw materials, and the character of the manganese ore used. Each manufacturer has his own ideas on this subject. The quantity used is figured in terms of pounds of manganese dioxide per 1,000 pounds of sand, which constitutes 50 to 75 per cent by weight of the entire batch. The temperature employed in the glass-making process helps to determine the quantity of manganese dioxide used, for because of volatilization the higher the temperature, the more manganese is necessary. The maximum limit is 10 to 15 pounds by manganese dioxide per 1,000 pounds of sand, and the minimum may be 2 to 2½ pounds.

Chemistry of Use of Manganese in Glass-making Process

Compounds of manganese, when other coloring ingredients are absent, produce pink, purple and violet hues according to the chemical nature of the glass. Manganese dioxide neutralizes the green color caused by iron compounds. Used in excess, it imparts an amethyst tint, and when used in considerable excess, the color is so dark as to appear black.

The neutralization of the iron tint by manganese dioxide is explained by some chemists on a physical, and by others on a purely chemical basis. The green tint is due to the presence of ferrous silicate. Some chemists think that this green compound is oxidized to the ferric silicate, which has an almost imperceptible pale straw-yellow color. According to this view, the oxidizing agent used must not completely decompose at high temperatures, and manganese dioxide seems to be the most available compound fulfilling this condition. At red heat, the dioxide loses one-third of its oxygen, leaving the tetraoxide (Mn_3O_4) which, at still higher temperatures, is an oxidizing agent.

Red lead and other oxidizing agents have not this decolorizing power. Hence some chemists have thought that the result is not due to oxidation, or chemical reaction, but is purely physical. It is possible, however, that other compounds may lose their oxygen at too low temperatures to be effective as oxidizing agents.

Specifications for Manganese Ore Used in Making Glass

Before the war, the ordinary specifications for manganese ore used in glass making were 85 to 90 per cent manganese dioxide and less than 1 per cent metallic iron. Outside of these two ingredients, each manufacturer has his own requirements. Special glasses may require ore carrying more than 90 per cent manganese dioxide and less than 0.5 per cent iron. The higher the manganese content and the lower the iron, the better the ore is for glass making. In general, the grades of ore are similar to those used in making dry cells. Obviously, siliceous pyrolusite is not objectionable but carbonaceous pyrolusite is.

Manganese ore for glass making is sold in powdered, granulated, or lump form. There are objections to the lump form because of the time required to melt it into the batch. Powdered ore is used principally when the batch is melted in pots; lump, or granular ore is used when melting is done in tanks.

Before the war, high-grade pyrolusite for glass making and other chemical purposes was imported from Russia, Saxony, Japan, Nova Scotia and other foreign countries. As the war progressed, such ore became scarce and, as a consequence, specifications were relaxed and low-grade ores were purchased. During the war some excellent domestic ore was developed, which found a ready market.

*Bureau of Mines, Department of the Interior, *Bulletin* 173.

Further News of the German Glass Industry

Large Profits Made by German Factories

(*Special Correspondence to* THE GLASS INDUSTRY)

BERLIN, December 10, 1920.

The Leipzig Fair, to which all Germany looked as the barometer of foreign trade conditions, is over—and with a unanimity seldom met with, the German press acknowledged that from a purely business point of view the Fair was a "down and out failure." Sales were lagging to an unheard-of extent and the decrease in the number of foreign visitors gave ample food for reflection. Among the few industries that did a fairly good business at the Fair was the glass industry. The opening days did not look very promising but the closing days showed an improved buying activity and your correspondent learns that among others the United States placed comparatively large orders.

As to the general situation of the glass industry, a distinct increase in sales is noticeable of late. Most of the works are fairly well supplied with orders, chiefly for abroad, but shortage of raw materials and the coal famine are still the outstanding features of the situation. A report from the Silesian glass work districts shows that while the extreme shortage of soda has improved somewhat of late, supplies are still meagre and wholly unsatisfactory, hampering operation at the works to a considerable extent. Such indeed is the shortage of raw materials that some of the works were compelled to cut working hours although orders on hand called rather for an extension of plants. An attempt was made to obtain raw glass from Bohemia (Czecho-Slovakia) but did not prove a success on account of high cost and increased customs duties. Production at present is chiefly confined to bottles, food preserving glasses, etc., while the output of luxury glassware shows distinct signs of picking up again, though still being a long way from the pre-war figures. There is also a fairly brisk demand for crown glass, though production is limited for the aforementioned reasons.

The coal supply, however, is the all-absorbing topic in the glass industry and great apprehensions are being felt by German manufacturers as to the future outlook for the industry. It will be remembered that under the terms of the Peace Treaty Germany has to deliver two million tons of coal per month to the Allies and it goes without saying that this deficit in the supplies of the home industry cannot possibly be made up despite the greatest exertions. To what an extent the coal shortage will affect the glass industry may be judged by the fact that the coal supplies to the glass industry during August were but 50% of the May deliveries, while the latter were but 30-60% of the pre-war quantities, so that the present deliveries work out at say 22% of the peace time supplies. While the situation from the German viewpoint is therefore very serious it will become absolutely critical should the plebiscite to be held in Upper Silesia vote in favor of Poland; in fact such an event is generally considered the last straw that will break the back of the German economic and industrial structure. The danger is fully understood in Germany and strong efforts are being made to reconstruct and adapt existing plants for lignite and even peat. It is safe to predict that for years to come the German glass industry will not be in a position to afford the luxury of burning pit coal, having to be content with the inferior lignite. Even the delivery of briquettes will largely be confined to glass works producing goods of importance to the community or for export.

The glass works of Lusatia (Lausitz) were among the first to utilize lignite and will hardly experience great difficulties in overcoming the crisis. Of lignite there are fairly large quantities in Germany but owing to its inferior caloric value much larger supplies are required than in the case of briquettes, thus opening up a new problem of equal importance, i. e., railroads and transportation. Some of the glass industry districts are rather far away from the lignite fields and it is highly probable that the railroad authorities will put the distance limit for lignite at say 95 or 100 miles, with a view of relieving the pressure on the railroads.

The afore-mentioned facts plainly show that the very life of the German glass industry is inseparably connected with the coal supply problem, and the coming months will show to what extent the coal famine is affecting the industry.

Meanwhile it is interesting to note the upward trend of the shares of many glass companies during the last weeks. The interest shown in the shares is largely to be explained by the publication of the business reports of some of the largest glass works, which would indeed prove that the past year has been a prosperous one for the industry, as may be seen from the following:

AKTIEN-GESELLSCHAFT DER GERRESHEIMER GLASHUETTENWERKE VORM. FERDINAND HEYE, DUESSELDORF-REISHOLZ. The net profits amount to 3,647,817 marks and a dividend of 19% was distributed plus a bonus of 5%. A report issued by the board of management states that the bottle production involved losses, which, however, were made up by the "not inconsiderable profits" derived from the plate glass production and, through the exchange anomaly, on export goods. Ninety shares of the Anglo-Dutch Bottle Works, valued at 135,000 marks, were also distributed.

GLASHUETTE VORM. GEBR. SIEGWART & CO. AT STOLBERG, distributed a dividend of 20% as compared with 8% in the previous year.

BAYRISCHE SPIEGEL- UND SPIEGELGLASFABRIKEN AKTIEN GESELLSCHAFT AT FUERTH. The general meeting recently held agreed upon a dividend of 50% against 35% in the preceding year.

SPIEGELGLASMANUFAKTUR WALDHOF A.-G., AT MANNHEIM-WALDHOF. The balance sheet shows a net profit of 457,838 marks. A dividend of 10% on a capital of four million marks is distributed.

DEUTSCHE GLAS UND SPIEGELGLAS AKTIEN GESELLSCHAFT AT FUERTH. A dividend of 12½% and a bonus of 75 marks per share was distributed.

FUERTHER TAFELGLAS GESELLSCHAFT AT FUERTH. Distributed 40%.

AKTIEN GESELLSCHAFT GLASHUETTE ST. INGBERT. The business report shows that the past year brought very satisfactory returns. There was a keen demand for goods, excepting the last months, when the sluggishness of the wine trade caused a lag. The turnover amounted to 8,600,000 marks. After deducting 73,180 marks for depreciation, the books show a net profit of 821,815 marks, from which a 20% dividend was distributed, while 500,000 marks went towards a special reserve fund. The total capital stock amounts to 1,050,000 marks and will shortly be raised to 1,500,000 marks.

The report of the TAFEL-SALIN- UND SPIEGELGLAS-FABRIKEN A.-G. AT FUERTH, created a sort of sensation through the action taken by ths Central Committee of the Nuremberg Works Councils. The company, which has for the past twenty years always followed a very careful dividend policy, distributed 25% in 1918, 35% in 1919 and 40% in 1920, so that 100% of the total share capital was distributed within three years. The net profits of 2,670,000 marks represent more than three-fourths of the share capital.

The extraordinary height of the last dividend has had an unexpected result. The Central Committee of the Nuremberg Works Councils has decided to bring an action against the company for an offence against the usury laws, it being alleged that not only does the distributed dividend exceed the "fair and reasonable limit" but that the published balance sheet reveals even a much higher profit.

The Glass Industry

Published Monthly
by the
GLASS INDUSTRY PUBLISHING COMPANY, INC.
19 Liberty Street, New York

L. J. KROM.....President
W. S. COOPER.....Vice-Pres.
G. W. COOPER.....Sec'y-Treas.

Subscription Price.....$2.00 a Year
Single Copy.....20 Cents

Advertising Rates on Application
Forms close on the 1st of the month

Address all communications to
THE GLASS INDUSTRY, 19 Liberty Street, New York
Telephone, John 4046 Cable Address, Glasdustry

CONTENTS

	Page
Some Common Defects Occurring in Glass	1
Progress Made in Plate Glass Manufacture	3
Wax Coating for Tableware	6
The Manufacture of Mother-of-Pearl Glass	7
Silent Spokesmen in the Factory	8
Air, Oil and Water Separator	9
English and American Glass Industries Discussed by a Prominent Authority	10
Fuel Control in German Glass Industry	11
Designs for Illuminating Glassware	12
The Laboratory	13
Manganese Ores in Glass Making	14
Further News of the German Glass Industry	15
Editorial:	
Trade Secrets	16
Technical Consultation Service	17
Glass Container Association Urges Constructive Co-operation	18
Annual Meeting of the American Ceramic Society	20
Patents	21
Glass Factory Equipment and Supplies:	
Cutting Bottle Molds Automatically	23
A Recent Simplex Lehr Installation	24
A Water and Oil Strainer	24
The Hess Burner	24
Gas Producers Conserve Fuel	25
Trade News	25
Monthly Summary of Foreign Commerce of the United States	28
Current Prices of Glass-Making Materials	28
Stock Quotations	28

NEW YORK, JANUARY, 1921

Now Is the Time to Do It!

Scattered here and there throughout the industry there are no doubt a goodly number of eligible glass men who approve of the objects of the American Ceramic Society, appreciate what the Glass Division has done and is doing for the industry and who intend to avail themselves of the benefits of membership in it, but have "never gotten around to it." This is an opportune time for all so situated and for any others to whom the advancement of the industry is a matter of real concern, to join the society, attend the annual meeting to be held in Columbus, O., February 21st to 24th, listen to the papers to be presented, take part in the discussions, and last but not least in importance, enjoy the social features, renew old friendships with their fellow-workers and make new ones.

Trade Secrets

Secretiveness concerning manufacturing processes has always been characteristic of many of the chemical industries, especially in their early stages of development. Our own industry has frequently been severely criticised for following a narrow policy in respect to the suppression of information which in many cases could be given out without detriment to the giver and with immense benefit to the industry in general. Happily, however, the ultra-conservative publicity policies at one time almost universal among glass manufacturers and sometimes carried to ridiculous extremes, have been giving way to a more enlightened attitude towards the question and it seems certain that the time is not far distant when the majority of manufacturers will not only be willing but anxious to promote frank, open discussion of the technical problems in which they and their competitors all have a common interest.

Why do glass manufacturers who organize and support trade associations and confer with each other regularly in regard to commercial questions affecting the industry show only luke-warm interest in cooperation as applied to the solution of glass factory technical and operating problems? Is there a greater value inherent in a thousand dollars gained by means of a favorable tariff schedule, for instance, than in a thousand dollars saved in production costs? No, there is not, because the saving effected by decreasing production costs is cumulative and places the enterprise on a permanently sounder basis, while tariff gains, being subject to the whims of parties and politicians, may only be temporary.

Is it not logical, therefore, for all glass manufacturers to co-operate at least as closely on technical problems as they do on commercial questions? Some quotations from a writer in *Chemical and Metallurgical Engineering* are of interest:

> "A free exchange of information and a very general knowledge of and interest in plant processes are the best possible means for encouragement of additional development of the art and industrial advancement of the manufacturing plants engaged within the field in question—indeed, with any line of activity."
>
> "It is out of the question for any one company to know so much about a particular process, metallurgical, chemical, or what not, as to be unable to learn more if research and development are encouraged on all sides."
>
> "When you feel secretive, remember the other fellow may have a better line of information than yourself. Dissemination of information brings returns and is therefore not simply altruistic."

A phase of the subject sometimes overlooked relates to the training of young men for positions of responsibility in the future management of the great glass plants now in existence and the others that will develop as the industry grows. Even today there exists a scarcity of glass factory technologists and executives of the higher type, and the demand for such men is bound to increase as more and more factories are forced to adopt modern methods.

Where will the men come from who are to satisfy this present and potential demand for broad gauge plant executives and how are they going to fit themselves for their future responsibilities? They can get from their colleges and universities a theoretical foundation upon which to build; they

can attach themselves to a manufacturing plant and acquire a more or less complete fund of practical knowledge through contact with the actual operations of that plant, but aside from the knowledge gained in this way by personal experience, it is only through hearing or reading discussions of actual everyday problems by experienced and competent men that they can obtain anything approaching a broad knowledge of the whole field of glass manufacturing.

Far-sighted glass men who have the future of their own enterprises and the welfare of the industry in general at heart should find in this situation an incentive to do all they can in encouragement of the widest possible discussion of glass-making processes. They can do this by contributing freely from their own stores of knowledge, by encouraging their associates and employees to take part in discussions, and by giving their hearty support to the various worthy mediums for the dissemination of reliable data on glass, such as the American Ceramic Society, the Society of Glass Technology, the various Government research organizations and, we may add, the technical and trade press.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretentions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Answers to all questions will be made by mail as promptly as possible. The source of all inquiries will be held in strict confidence.

QUESTION 1.—We have an opportunity to purchase a large quantity of raw materials from which we can produce a hydrated potassium carbonate containing a few per cent of sodium carbonate and a few tenths per cent of potassium phosphate, in addition to the usual impurities of 1% potassium chloride and a trace of potassium sulphate.

We are anxious to know if the presence of the above mentioned soda and phosphate would render this material unsuitable for optical or other glass in which potash is used.

ANSWER.—One of the leading optical glass manufacturers requires hydrated potassium carbonate to be practically free from sodium salts at least under 1%, to contain less than 1% potassium chloride, and less than ½% potassium sulphate. In a general way they prefer this material to contain about 17% water of crystallization because from their experience the material stays more uniform in moisture content under their storage conditions. This company has never had any specifications regarding P_2O_5 content and they are not prepared to state what limit they would have to place on this impurity, although for most purposes they could allow up to 0.5% P_2O_5.

The specifications used by another prominent concern are as follows: SO_3, maximum, 0.3%; for Cl—1.0%. Regarding P_2O_5 they have no definite maximum specifications for this impurity inasmuch as their potash has never contained an appreciable amount of it.

Analyses of raw materials used by the Bureau of Standards in the manufacture of optical glass show that the maximum amount of P_2O_5 found in shipments of hydrated carbonate of potash was 0.18%. For ordinary pot glasses, that is, those usually made in pots, except the fine grades of real optical glass, a few tenths per cent of potassium phosphate—not over 0.5%—will not be objected to by the manufacturers.

QUESTION 2—When glass in melting end cools over week-end and refuses to flow through "dog-hole," what are your suggestions for remedying? Dog-hole opening is 18 inches by 12 inches.

ANSWER—Extended inquiry among glass men has not brought to light a single case of "freezing" of flint or green bottle glass in the throat or neck between the melting and refining ends of the tank. There have been found, however, cases of opal glass freezing in the throat when cooled over the week-end shutdown, particularly when water cooling was in use on the throat blocks. Sometimes it has been possible to open up the flow of the glass between the two ends of the tank, simply by heating up the two ends considerably above the normal temperatures. A few cases have been found where further treatment was necessary. In these the most satisfactory method has been to introduce ordinary white arsenic trioxide as near as possible to the frozen throats, and allow its boiling action to stir up the hot and cold glass until the stoppage was broken through. The method of introducing arsenic has been to put it in an old shoe or in a tin can wired on to the end of a heavy iron bar through the nearest available opening in the furnace. The rod is shoved down into the glass, and if necessary, from first one end and then the other. Potatoes, beets, wood blocks, etc., have all been tried.

It is common practice in the manufacture of optical glass to "block" with ammonium nitrate. The method of applying is to put a few ounces of the chemical in a thick paper, tying it on the end of a rod and then soaking in water. The rod is then inserted quickly in the glass and as the material is entirely volatile, a large volume of gas is quickly formed.

Your inquiry is a little indefinite to give an exact answer. We have never heard of the throat of a tank referred to as "dog hole," but it is certainly not possible that your trouble is in the dog house. An opening of 18″ x 12″ in the breast wall should be ample. You have not stated the most important dimension which is that of length. While it is very nice to have lots of room between the ends of your tank for repairs, air cooling, etc., it is possible to get a tank throat too long for satisfactory work. There is also the possibility that you are water cooling or air cooling your neck. The kind of glass also cuts a big figure. For example, window glass is much more subject to devitrification than is bottle glass; opal glass is melted at a much lower temperature than either window or bottle glass, and has a tendency to freeze up into a very dense mass much more quickly than ordinary glasses. There is a further possibility that a piece of caved in or cracked off block may have lodged in the throat.

Glass Container Association Urges Constructive Co-operation

THE Glass Container Association has adopted a broad gauged view of its position in the glass industry and has framed its program to extend its services to all phases of the glass industry, when such services will be appropriate and acceptable; also as a good-will measure, to all users of glass containers.

The main objects of our Association are to develop better, more economical and more practical glass containers, to provide an authoritative agency, which will exert an appropriate control over the products which go into glass containers, to promote a constructive publicity campaign and to establish an organization for the purpose of protecting the glass industry and its users from adverse and destructive legislation.

This program we believe can be carried out best by laying the basis for good-will and developing team work by processes of co-operation with such responsible groups as already exist in our greater industry composed of the makers and users of glass containers and their supply firms."

—Judge I. G. Jennings, Business Manager, Glass Container Association of America.

The Glass Container Association's Plan of Greater Industrial Organization

To Include the Manufacturers of Glass Containers and Their Supply Firms; Also All Companies Using Glass Containers for Their Products

The big job before the Glass Container Association is to promote a greater demand for glass-packed products, and to educate the public and the users of containers to a better appreciation of and larger demand for containers made of glass.

We recognize, as a fundamental truth, that in creating a greater public demand for glass containers, the container cannot be separated from its contents, and that measures taken by us to insure the increased sales of the products of those who use our containers, is the most constructive way of promoting the prosperity of our members.

Therefore, our cardinal principle is to back to the limit of our association's resources the users of glass containers.

This principle will be in operation not only in fair times but also whenever any user or group of users of our containers is suffering from unwarranted attack. But, both in promotion and defense, we will initiate and emphasize at all times constructive methods. This fact, we believe, will appear in and justify the following suggestions:

If in promoting a greater demand for glass containers, the container and its contents cannot be separated, neither can they be separated in promoting greater sales of glass-packed products. The logical conclusion from this is, first, that the manufacturers of glass containers and caps, second, the packers of foods, drinks and drugs in glass, and third, those who furnish these groups with their supplies, are all natural members of a great major industry, hereinafter occasionally referred to as the Glassed-Products Industry, the several branches of which are each undeniably and vitally interested in each other.

The greatest success and stability of any one branch of the major industry can only come through the most complete co-operation between its several branches and the adoption of a policy of unity among all of its parts, to the end that the product itself shall have a progressively better container, and the container the safest and highest quality of products and that the public shall be made to thoroughly appreciate these facts.

It can confidently be assumed that each branch of the Glassed-Products Industry desires its own greatest success and can probably see advantages coming from co-operation and unity of policy with the other parts.

But all business experience has shown that what is everybody's knowledge may be nobody's business. Therefore, to insure such co-operation and unity some agency must make it its business to bring about these advantages for the entire industry.

In developing our plans, however, there are certain reasons which induce the Glass Container Association to take the initiative at least in such a movement. First, we know of no other of our associations that has co-operation and unity for the whole industry, as a major part of its program; second, the extension of co-operative service is in line with our present program; and third, our association undoubtedly and naturally has a more general interest in the prosperity of all groups, for whatever may be the contents of the glass package, our particular industry furnishes all the containers, while both the supplies that go into the making of containers and the contents thereof are produced by many different industrial groups, no one of which could be expected to be so keenly interested in the success of all types and kinds of products or of glass-packed goods, as in their own.

Assuming, therefore, a responsibility which seems to arise from our position in the major industry, we present for the consideration of the various groups of the Glassed-Products Industry and certain individual interests which have not as yet become associated together, an outline of our views and a plan for co-operative action which we hope will be received in the same spirit in which it is offered.

To begin with, we recognize the fact that certain branches of the greater industry are represented by thoroughly established and functioning associations, well-officered and with definite programs in the process of administration. We wish to emphasize the fact that our plan of co-operation will not interfere with the integrity or permanence of such associations. We further believe that all independent firms allied by interest to this movement and producing like products or having like aims, should as soon as possible associate themselves together as a matter of progressive industrial policy. But above all, we believe that every association at present existing or to be formed in the future, should be so constructed as to contemplate co-operation and to permit it to function in the most efficient manner. To illustrate:

All of our associations have certain common characteristics, i. e.:

(a) They have officers and directors, headquarters more or less permanent, and in some cases a paid secretary.

(b) They meet periodically, if only annually, to discuss trade problems for the coming year.

Obviously, the above is not the field for co-operation.

There are, however, three major lines along which co-operation and unity of policy offer especial advantages to all those participating, i. e.: 1, Constructive; 2, publicity; 3, legislative or protective.

Constructive.—We would not only suggest, but emphasize the necessity of each of our associations to provide some permanent agency whose office it will be to get down underneath the problems of their industry, to study them intensively and to solve them for the constructive betterment, not only of their particular group, but also in harmony with the welfare of the greater industry. Plainly the best agency for this purpose, in any food, drink or drug line, is the industrial laboratory.

Publicity.—Real industrial progress makes it necessary for each association to contemplate sooner or later, a program of pub-

lic education and intelligent publicity, advocating the merits of their products generally and promoting greater sales and consumption thereof. This program may be ever so modest but should not be neglected, since no industry is able nor can afford to stand still.

Legislative or Protective.—A well understood method of collecting, analyzing and tabulating industrial facts should be determined upon and the machinery devised by which more or less of the weight of the whole industry, according to the nature of the case, may be brought to bear upon legislative bodies or committees, for the purpose of obtaining constructive legislation or protecting the industry against destructive regulation.

Under each of the above headings, the closer the co-operation and the more highly unity of policy is developed, the greater will be the economy and efficiency.

Specifically, then, our plan is this:

That your association together with such other associations in our greater industry as join in the movement:

1. Select a first-class chemist or laboratory specialist who will devote his whole time to the study of those problems exclusively, which will be of the greatest interest to the members of your group. Let this work be done under the same roof where the different scientists are working together, thus gaining the advantages of daily collaboration with each other and of the reduction of the overhead expense for your association to the minimum. If a sufficient number of our associations will thus join together in promoting laboratory study and publication, the essentials of a great pure products institute or foundation will be created and such foundation will become, without doubt, the most authoritative privately maintained scientific organization specializing in food, drink and drug problems in the country. Its co-operation would immediately be sought by both state and federal scientific agencies. This would offer our industry a wonderful opportunity for obtaining government and ultimately public goodwill.

Our plan provides that the maintenance of such a man could easily run as low as from $5,000 to $10,000 for your association, or at least, a minimum cost with maximum results. This is so because the Glass Container Association is prepared to help materially in making it so. Our laboratory is at present equipped to handle the general problems of our own industry and those of the various users of glass containers up to the limit of its present man-capacity. It took us perhaps six months' time to find a suitable location and to instal the equipment. Such time, obviously, could not be very productive of results for any one. But our location in Chicago is good and our rental extremely low. It is doubtful if any other group contemplating now or in the future the installation of a laboratory, could at the very minimum prepare itself for laboratory work at a lower cost than that of ours.

Our laboratory is large and we have plenty of room. Therefore, we offer this space, free of charge, to those in our industry who will join us in this great movement. We will temporarily loan to you equipment. You can begin work on your own problems tomorrow, if you will, with no loss of time. You can thus see that the cost will be very little above the salary of your scientist and cost of equipment and necessary supplies.

To sum up, this work done co-operatively will be:

(a) More forceful as representative of a large and more powerful movement.

(b) More authoritative, as resulting from greater collaboration, and performed under better scientific conditions.

(c) More acceptable to the scientific world and the public because broader and more authoritative. This fact will multiply many times the publicity value of the bulletins issued, over similar work produced by any particular group laboratory working alone.

(d) More efficient because better organized and with consequent less waste of effort and time.

(e) More economical because the overhead will be reduced to the minimum and better consideration given to preparing the program to be carried out.

Therefore, we believe that we are conservative when we maintain that your group working alone could not produce for your branch of the industry as authoritative or valuable results as it could in working co-operatively with the other groups of our industry. The only question is this: Is your association progressive enough to seize this opportunity while the offer is open? Such work will give every member of your association laboratory service and better standing before the public. We believe that this should be your minimum contribution to your members and to the progressive development of your business. The beauty of it all is, that while your scientist and those of the other groups are working for better products, our experts are at the same time developing better and cheaper containers. Thus even more truly than at present we can make the claim to quality products in the quality container.

2. Our plan further recommends that you consider at once the ways and means for educating the public to the merits of your product. The appropriation for this purpose need not be large at first, but should be intelligently spent, and your program should gradually broaden until it is thoroughly representative of the resources of your group. Again our association comes forward with an unusual offer.

If you can see your way clear to a campaign of national advertising, we will become one of your principal contributors, say, for the purposes of discussion, to the extent of 1/10 of the sum that your industry will raise and provide for spending for this purpose. When your money is raised, together with that which we will contribute, our plan is that every cent of it shall be spent for advertising the products of the members of your association or the group with which you unite. It makes no difference how you raise the money, whether by assessments or as based on the number of cases sold; in any case we will match you as indicated above.

It is obvious that the raising of funds will be made easier for you by the knowledge that other groups are also raising funds at the same time, for the same purpose. Often an association feels that, while a very considerable sum might be raised for advertising in the industry which it represents, in comparison with some appropriations for this purpose, it would be comparatively small and so hesitates about taking such a step. We do not believe that this fact need embarrass you to the same extent as if your group alone were to finance the advertising, for here again we have another recommendation that will tend to give greater proportions to the smaller appropriations, viz.: that the several co-operating associations bring about their advertising campaigns as nearly simultaneously as possible; further, that while every cent of the money raised by each group would be spent on its own product, and according to its own plans, yet prudence and business judgment would suggest that much might be gained by extending the principle of co-operation and unity, even if somewhat limited, to the publicity of all. This might be done by the appointment of one or more representatives from each group to meet in common council and to direct the advertising, so far, at least, as to avoid duplication and to insure that the advertising of no one of the co-operating groups would be harmful to any other. The effect of such advertising would be cumulative and your business would receive reflected advantages from the advertising of the other groups.

In addition to our contributions to the advertising funds of the various groups of the users of glass containers, and necessarily conditioned somewhat upon their willingness to conduct their publicity campaigns more or less simultaneously with the other co-operating groups, the Glass Container Association contemplates conducting a national advertising campaign of its own, the object of which will be to supplant all other group advertising and to urge the desirability and value of glass as a container and for packaging purposes. An inestimable benefit will thus accrue to the co-operating groups and to all other users of glass containers

inasmuch as all will receive alike the advantages of the money spent and the support given by us to the type of package all are using. The effect will be nearly the same as if each of the groups were spending, in advertising its own package, an additional amount equal to the appropriation of the Glass Container Association. But, when spent by our association, as indicated above, this same money will be made to work over and over again according to the number of advertising campaigns simultaneously conducted. Obviously, therefore, such advertising by us will be in effect an additional contribution to our direct offer of 10 per cent. above.

3. Coming now to the third consideration in our plan, the formation of such a general council would suggest a method by which our legislative program might be worked out most effectively. The judgment of the whole industry would thus be obtained in selecting those best suited to represent it in obtaining legislative justice. Similarly, plans for obtaining such industrial facts as would enable our representatives to make the best showing of strength and influence before legislative committees could also be considered and provided for.

The Glass Container Association is here making an offer of a type of co-operation that ought to appeal to every branch of our major industry and inspire confidence throughout. Obviously, such an offer cannot remain open indefinitely. Our contributions will be made to the several publicity campaigns with the understanding that, by illustration or otherwise, a connection be made between the product advertised and the glass container. Further, our offer of contribution is made on the understanding that a number of the groups will avail themselves of the oppportunity to thus join together in the publicity movement.

The offer of our laboratory space is predicated on the assumption that the scientists selected by any group will be agreeable to Dr. A. W. Bitting, the director of our laboratory, and that he shall be designated as the directing head of the newly developed institute.

We believe the plan set out above is unique in that the individuality of none of the co-operating associations will be sacrificed and the work done both in the laboratory and in the publicity field will be just as positive and direct as if separately performed by each group, but having the additional advantage of the stimulation to effort that comes in an atmosphere where everybody is working at capacity.

Above everything else there is inestimable value in the fact that the *whole industry is constantly mobilized and ready for action.*

If you use glass containers in your business, is it not worth while for you to know and to assure yourself that a constructive agency is constantly at work developing a better and stronger container, a cheaper container, a more practical container for shipping, a better fitting and more efficient cap, a more practical shipping case, a better and more uniform product for your group and your own business, protection against unjust publicity, protection against adverse legislation, more equitable freight rates, the most economical and efficient laboratory service, the most economical and efficient publicity service and a clearing house of invaluable industrial information?

We believe that the plan set out above will permanently insure these advantages to your business.

What does the Glass Container Association ask in return? Only this, that you place yourself in a position where the public will recognize more and more the merits of your products, will buy and consume more of them and at the same time be protected in the quality of the products it buys in glass. In other words, that your own business and that of every other member in your group adopt proper measures for insuring to yourselves the enjoyment of a more general and lasting prosperity based on the above principles and participating membership in perhaps the most efficiently organized industry in America.

The Glass Container Association of America whose plans for co-operation between the makers and users of glass containers include an extensive publicity campaign, has placed its advertising account in the hands of one of the oldest and best known advertising agencies, N. W. Ayer & Son, Philadelphia, Pa.

Annual Meeting of the American Ceramic Society

Secretary Charles F. Binns, of the American Ceramic Society, has sent the following bulletin under date of December 9th to the members of the Society:—

The 1921 Annual Meeting of the Society is to be held February 21-24, at the Hotel Deshler, Columbus, O., Professor Arthur S. Watts being the chairman of the local committee. The commodious meeting rooms and splendid equipment of the hotel make it an ideal place for a large gathering. Its popularity at all times is so great as to make it imperative that members should make reservations well in advance. It is not too early now to engage accommodations.

Special attention will be given this year to the entertainment of ladies who accompany members to the meeting. Mrs. Watts has charge of the arrangements and an exceptionally enjoyable week is promised.

Section Q and the banquet will occupy pleasantly the first two evenings, and on Thursday trips will be taken to the Ohio State University and the manufacturing plants with which the vicinity of Columbus abounds.

The industrial divisions will have separate sessions and the new division on Ceramic Decorative Processes will meet for permanent organization. One or more sessions will be devoted to kilns, saggers, and problems of burning.

It is most important that careful thought be given at once to the preparation of papers. The program last February was the strongest ever given and the standard must not be lowered. Everyone should consider it a personal responsibility to attend the meeting and to present a paper or discussion.

HOTEL RATES AT COLUMBUS

The rates given below are not guaranteed to hold for February, 1921, but the hotel managers are not anticipating an increase and it is probable that the rates will be in effect at the time of the annual meeting of the American Ceramic Society. Those who plan to attend should make reservations at once, obtaining a reply from the hotel chosen. Deshler Hotel, $2.50 to $6.00; Chittenden Hotel, $2.00 to $4.00 and up; Hartman Hotel, $2.00 to $6.00; Neil House, $2.00 to $6.50; and Southern Hotel, $2.00 to $4.50 and up.

In addition, there are several smaller hotels and an Athletic Club at which some members may find accommodation.

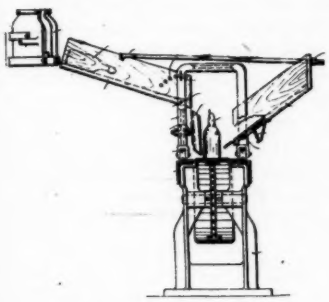
Secretary E. Ward Tillotson of the Glass Division, American Ceramic Society, in a bulletin issued December 20th, requests all members and others who intend to present papers at the Annual Meeting in Columbus, to inform him immediately of the titles of the papers to be presented. Dr. Tillotson laments the small increase in membership in the Glass Division since the last annual meeting and urges the members to bring in as many new members as possible before the February meeting in Columbus.

Nominations as follows, to fill the offices of the American Ceramic Society for the year 1921-1922, have been decided upon by the nominating committee: For president, F. K. Pence, of the American Encaustic Tiling Company, Zanesville, O.; vice-president, F. B. Ortman, Northwestern Terra Cotta Company, Chicago, Ill.; treasurer, R. K. Hursh, University of Illinois, Urbana, Ill.; trustee, R. M. Howe, Mellon Institute of Industrial Research, Pittsburgh, Pa.

Patents

RECENT INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS FOR PRODUCING IT

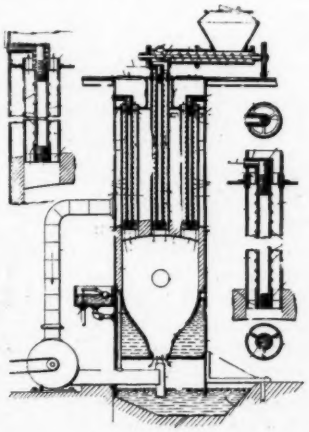
Bottle-Transferring Apparatus. U. S. 1,358,913. Nov. 16, 1920. Glenn Young, Coshocton, Ohio, assignor to The Owens Bottle Machine Company, Toledo, Ohio, a corporation of Ohio.



This invention, as will be seen from the accompanying illustration, consists of a horizontally moving conveyer, an inclined chute to which bottles are delivered neck end downward and down which the bottles slide by gravity, and a means of directing the bottles to an upright position on the conveyer, the movement of the bottles down the chute and to said upright position being caused by and dependent solely on the action of gravity on the bottles.

Process of Making or Treating Producer-Gas. U. S. 1,361,137. December 7, 1920. William B. Chapman, of Mount Vernon, Ohio, and David Mason, of New York, N. Y., assignors to Chapman Engineering Company, of Mount Vernon, Ohio, a corporation of New York.

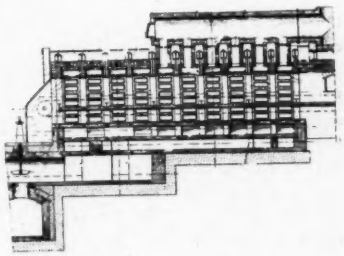
This invention relates to a novel process of and apparatus for producing gas from coal and kindred substances in a simple, effective and economical manner. The numerous difficulties encountered in operating ordinary gas producers are well known, one of the principal objections being that the producers require a constant and intelligent observation by the attending workmen in order to produce a uniformly constituted gas. The proper operation of the producer plant thus depends to a high degree upon the retinue of a staff of skilled workmen. To solve this labor problem and overcome some of the many irregularities of operation, the powdered coal type of producers has been attempted, but so far has failed in practice because of the prohibitive amount of soot contained in the gas whenever the same is otherwise of good quality. Another disadvantage inherent in this type of producers consists in the necessity of shutting them down during ash removal.



The inventors claim that they have overcome these and other difficulties by making use of the principle of ionizing, and applying the latter more particularly to the generated gas as the same leaves the gasifying chamber and while it is still hot. Owing to this ionizing process the soot and other impurities contained in the gas are precipitated and directly returned to the gasifying chamber, to be here subjected to renewed gasification. At the same time, the ionizing of the hot gas stimulates its chemical activity to such an extent as to complete the chemical reactions brought about within the gasifying chamber. This novel process is equally applicable to powdered solid fuel as well as to atomized liquid fuel. When using solid fuel it is preferable to ionize the same prior to gasification, whereby its chemical activity is stimulated and the chemical reactions which are to follow during gasification are intensified. In this way a pure gas having a high calorific value may be produced from a comparatively cheap grade of fuel in an economical, simple and thoroughly reliable manner.

Glass-Annealing Lehr. U. S. 1,361,604. December 7, 1920. Edwin E. Milner, of Scott Township, Allegheny County, and William J. Lytle, of Rosslyn Farms Borough, Pennsylvania, assignors to H. L. Dixon Company, of Carnegie, Pennsylvania, a corporation of Pennsylvania.

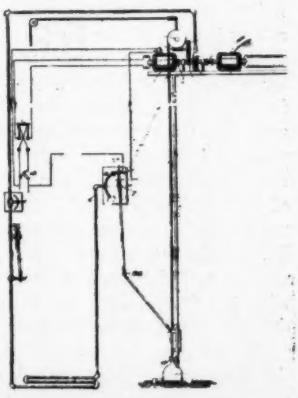
The invention relates to annealing lehrs or furnaces of the type which is especially adapted for the annealing of glassware, and which is further of the muffle type in which the products of combustion or flame do not come into direct contact with the ware, the ware being annealed by the action of heat which passes through the flue walls.



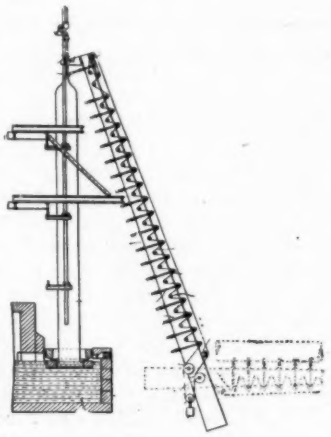
One object of the invention is to provide a lehr of this character with an improved flue arrangement for distributing and circulating the heating medium around the annealing chamber, whereby a substantially uniform annealing heat may be obtained within said chamber at any given cross section thereof, while the heat at different portions of said chamber may be regulated and controlled effectively as may be desired.

Apparatus for Drawing Glass Cylinders. U. S. 1,361,635. December 7, 1920. Arthur E. Spinasse, Mount Vernon, Ohio.

This invention relates to what may be termed a single motor glass drawing machine. It is a method of co-ordination between the various functioning elements comprising in a practical way a structure so arranged that a single motor may be utilized for operating the drawing means and at the same time the generating means for generating the air pressure which is supplied preferably in a novel and useful manner to the drawn article. In operation any variation in the speed of the motor or working condition of the mass of molten glass, thus varying the speed of the draw, likewise varies the amount of the air pressure generated and supplied to the drawn article. The inventor claims that with the use of this machine a better article is produced.



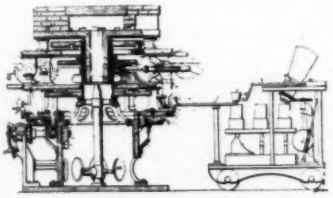
Apparatus for Supporting Glass Cylinders. U. S. 1,361,855. December 14, 1920. Herman S. Heichert, of Pittsburgh, Pennsylvania, assignor to Pittsburgh Plate Glass Company, a corporation of Pennsylvania.



The apparatus shown in the accompanying illustration relates to a device for taking down and otherwise supporting the glass cylinders formed in the manufacture of window glass. The invention has for its primary objects the provision of improved and simplified means for causing the cylinder supporting arms to engage the cylinder with uniform supporting pressure regardless of any lack of straightness in the cylinder or variations in the diameter thereof. The invention is illustrated as applied to a takedown apparatus, but is applicable to any supporting frame for glass cylinders whether for use in taking down cylinders or supporting them in other relations.

Since the arms are all supported upon the same cable and as the cable runs freely around the various pulleys, the pressure exerted by each arm upon the cylinder is substantially the same, and this is the case regardless of any variations in the straightness of the cylinder or its diameter. The cylinder is thus uniformly supported, both during the taking down operation and during the cutting up operation, and breakage incident to strains induced by uneven support of the cylinder is entirely avoided.

Glass Handling Apparatus. U. S. 1,362,756. December 21, 1920. Theodore C. Steimer, deceased, late of Pittsburgh, Pennsylvania, by Charles M. Steimer, administrator, of Pittsburgh, Pennsylvania; said Theodore C. Steimer assignor to Empire Machine Company, a corporation of Maine.



This machine, which is adapted for the glazing or fire-polishing of glassware, comprises a constantly revolving frame, a furnace with properly heated openings, and glass-handling devices for presenting the glass articles to the furnace openings, being mounted on and moving with the frame, and transfer devices for receiving the articles from a fixed delivery station, and for positioning them where they may be taken up by the glass-handling devices, and for taking them from such devices and delivering them to a fixed receiving station. The transfer mechanisms, which constitute an important feature of this invention, both move with, and move relatively to the revolving frame, and so may be held stationary at times. During the latter period, they are successively in registration with one of the fixed stations. During the period they move with the frame, they are in such co-operative position with the glass-supporting mechanisms as to deliver to the latter, or to receive therefrom, the article under treatment, while the motion of the transfer devices in respect to the traveling frame restores such transfer mechanisms to the angular position which they occupied on the frame prior to the stoppage of their motion in respect thereto.

Glass and Its Manufacture. U. S. 1,362,917. December 21, 1920. Louis E. Barton, of Niagara Falls, New York, and Henry A. Gardner, of Washington, District of Columbia, assignors, by mesne assignments, to Titanium Pigment Company, Inc., a corporation of Maine.

The present invention is based on the discovery that if relatively large quantities of suitably prepared titanic oxide (TiO_2) are used it not only increases the fusibility of the charge and the fluidity of the melt to an extent proportional to the increase of the amount of the titanic addition to the charge or batch, but also there is thereby obtained a more easily "workable" throughout uniformly translucent, or, if desired, perfectly transparent glass without undue variations of the known ranges of temperatures within which such glass may be expected to remain plastic and workable during its isolated molding by aid of such manipulations of the melt as blowing, casting, pressing, etc.

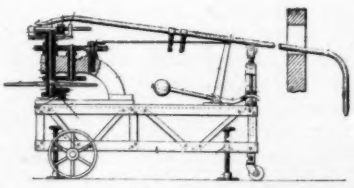
For better understanding, the following formulæ of proportions of constituents of various charges successfully employed in the practice of the invention, and indicating some of the practical variations permissible in respective proportions of the titanic and other materials, is submitted.

Batch numbers:	2	3	4	5	6	7
Silica (parts by weight).....	69	69	69	54	39	24
Borax (parts by weight).....	10	10	10	10	10	10
Sodium carbonate (parts by weight)	29	29	29	29	29	29
Lime (parts by weight).....	7	7	7	7	7	7
Titanic oxide (parts by weight)....	15	30	45	15	30	45

The desirable properties imparted by the titanic oxide to the final products are largely attributable to the isolation of the glass batch during fusion and the isolation of the resulting melt thereafter and during its molding, whereby is prevented any such combinations with other elements during formations as occur in enameling and glazing owing to contact of the batch with the foreign objects coated, the result being a vitreous covering which is not throughout homogeneous, not uniformly constituted, but, on the contrary, often contains in proximity to the object elements derived from the latter.

Glass-Stirring Machine. U. S. 1,361,853. December 14, 1920. Charles R. Hazel, of Charleroi, Pennsylvania, assignor to Pittsburgh Plate Glass Company, a corporation of Pennsylvania.

The invention relates to machines for stirring molten glass. It has for its principal objects: the provision of an improved machine wherein the stirring element is given a path of travel such as to give a complete agitation of the body of glass; the provision of a machine in which the path of travel of the stirring element is constantly changed and in which the path of travel is not repeated to the end that a maximum quantity of the glass is exposed to the action of the stirring element; and in general the provision of a machine, simple in construction, efficient in action, and requiring a minimum amount of attention and repair.



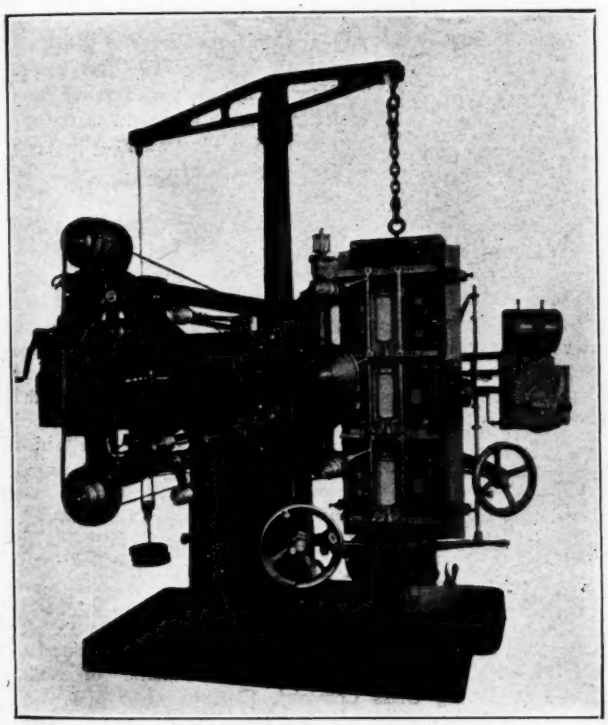
The apparatus is particularly designed for use in the manufacture of glass which requires very thorough agitation, such as optical glass, and this agitation is secured by means of a stirring rod having its end down turned, and adapted to be inserted through the opening of the usual type of covered pot. Briefly stated, the mechanism comprises a power-driven device adapted to give the end of the stirring rod or element a circular movement with a constantly changing center and also an up and down movement.

Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish in this department descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the information printed in this department comes direct from the manufacturers of the products described.

Cutting Bottle Molds Automatically

During periods of heavy demand for bottles, many bottle factories have found that the supply of molds has been the limiting factor in production. With the introduction of automatic machinery for cutting bottle molds there was considerable discussion and some skepticism expressed as to the possibility of making a commercial success of the automatic mold cutting



THE KELLER AUTOMATIC BOTTLE MOLD CUTTING MACHINE

The master mold is in the middle compartment. The travel of the platen carrying the work and master is in a vertical plane. The travel of the swinging arm carrying tracer and two cutters is in the horizontal plane. Stops automatically control all movements

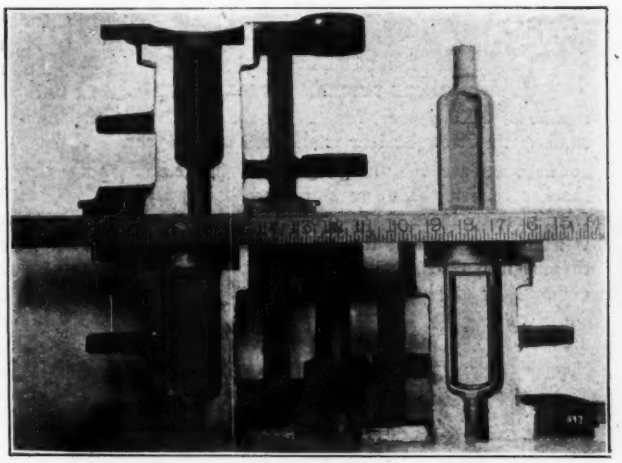
operations in which heretofore hand labor had been considered indispensable.

It is for the purpose of showing just what has been accomplished along this line and what may be expected of the machines that the following data, supplied by the manufacturers of the Keller automatic die sinking machine, are given. It has been ascertained that this machine is in regular operation in a number of mold manufacturng shops and that within the understood limits of the apparatus the management in each of the several cases referred to is well satisfied with the operation of the machines and with the manufactured product. In these shops the machines have undoubtedly done away with considerable hand work and speeded up production.

The Keller machine is automatic in a broad sense. It is motor driven and entirely self-contained and requires very little operating attendance. Without any previous machining, the rough scaled blanks are cut very rapidly to a scrape finish. Two mold sections are cut simultaneously. The guide or master is an existing mold which this machine reproduces accurately and uniformly. Panels, flutes, square and odd shapes or ornamental features present no difficulties. The machine handles with equal ease the most intricate design and the comparatively simple blank. Plural impression molds are cut as easily as the single impression.

The mounting of the mold sections on the machine is a simple matter. A fixture is provided on which the sections are held and aligned by neck and face.

Through variable speed motors and mechanical speed regulation, the maximum of travel is obtained and automatically adjusted to the varying conditions of the job. No formed cutters are required, only simple end mills are used and for the upkeep of these and also for the tracer and guide points, a specially designed



MACHINE TYPE NO. 541.

Blank half mold as it is mounted on the machine and complete mold as it comes off the machine and plaster from it

TIME RECORD CUTTING TWO HALVES OF PANEL BOTTLE MOLDS IN CAST IRON

Automatic roughing cut, using ¼" 7° 2 flute mills, feed .016...	40 minutes
Automatic finishing cut, using 7/64" 7° 2 flute mills, feed .008..	80 minutes
Total for both sections.....	2 hours
Attendance required by machine:	
Setting up molds.....	¼ hour
Setting cut	¼ hour
	½ hour

The manufacturer points out that the machine, being fully automatic, the attendant can grind mills in spare spindles and do other work while the machine is running.

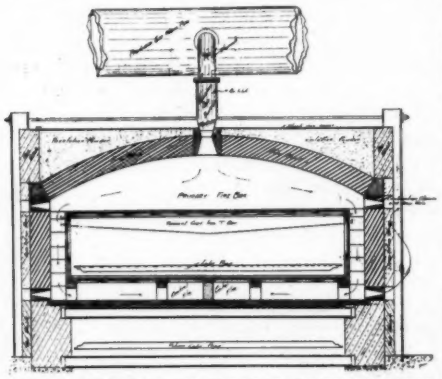
grinder is furnished. The machine is built in two sizes with mold capacity of 11" and 13" respectively.

The Keller Mechanical Engraving Company, Brooklyn, N. Y., who for many years have been building automatic machines for various die and mold using industries whose problems were similar to those confronting the glass trade during the past few years, developed the bottle mold cutting machine during the war when mold making facilities were entirely inadequate to meet the demand existing at that time. They maintain a service department which includes instruction at the place of installation and putting the machines in production.

A Recent Simplex Lehr Installation

One of the most recent installations of Simplex Muffle Continuous Type A. A. Lehrs, at the plant of the Federal Glass Company, Columbus, Ohio, is described by the engineers and builders as follows:

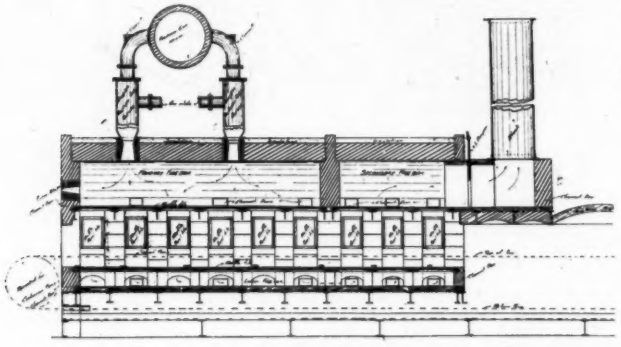
This installation consists of two lehrs, 60 feet long and 9 feet wide, for soda glasses and blown tumblers, and one lehr 70 feet long and 9 feet wide, for stem ware and pitchers or jugs.



CROSS SECTION OF TYPICAL SIMPLEX LEHR

The conveyor part of the lehr is constructed with malleable griplock roller chain with a working strain at 200 feet per minute of 6,000 pounds, for pulling the pans. This, the builders state, is the strongest lehr chain used on any lehr.

The pans are No. 10 gauge steel, flanged so as to give a channel section. This section gives strength and keeps pans from warping in heat. To prevent any sagging in the pans there is a roller support at the center of which each pan rolls on a channel iron track. All shafting and sprocket wheels are made extra heavy to guard against breakage and wear. All bearings



LONGITUDINAL SECTION OF TYPICAL SIMPLEX LEHR

are lubricated by grease and oil cups placed so as to be easily accessible.

The bearings at cold end of the lehr are cast steel and of take-up type. This is to take care of slack in chain due to expansion and to eliminate any change in location, at hot end of lehr, of lehr pans, so as not to interfere with an automatic carry-in device.

The lehr is motor driven and speed reduced by a double worm reduction. Although but a one-and-one-half to two h.p. motor is required to drive the lehr, a five h.p. motor is supplied on account of greater efficiency.

The Simplex flat arch muffle is used on this lehr. This presents a rectangular fire box with the roof of muffle equally distant from pans at all points thereby insuring uniform heat on ware. The upper or roof tile are supported by cast iron beams upon which the tile can slide when expansion takes place, instead of cracking, which so often happens where an arch roof is used.

The heat is distributed on the top, sides and bottom of the ware, in fact on all sides, and the temperature is kept uniform by means of dampers on each flue. No flame comes in contact with the ware; the annealing heat is radiated heat only. The entire lehr is insulated so as to give the greatest fuel efficiency.

These two lehrs were designed and constructed by the Simplex Engineering Company, Washington, Pa., of which H. M. Thompson is secretary-treasurer and C. E. Frazier, president.

A Water and Oil Strainer

Power plants which secure their raw water supply from such sources as rivers or lakes, require strainers to prevent weeds, sticks, marine plants and small fish entering pipe lines. Strainers are also required on the suction and discharge lines of lubricating oil and fuel oil systems, for the removal of solid foreign material in suspension.

GRISCOM-RUSSELL STRAINER

For this purpose The Griscom-Russell Company, 90 West Street, New York, have placed on the market a strainer as shown in the accompanying illustration. The body is constructed of cast iron and the strainer basket of perforated sheet steel. When the strainer is to be used on an oil line the basket is lined with wire mesh.

The G-R Strainer is of the single type and may be installed either as a single unit, or as the G-R Strainer Set. This set consists of two of these strainers connected complete including two three-way valves and necessary connecting elbows, unions and nipples. This arrangement permits the cleaning of either of the two units without interruption of the service. Two styles of strainers in various sizes are made, the bolted top design having a working pressure of 300 pounds per square inch, and the crab top design, a working pressure of 5 pounds per square inch. Form sheet No. 168 describing this apparatus will be forwarded by the manufacturers to interested persons.

The Hess Burner

Further particulars regarding the first trial on a commercial scale of the Hess pre-heating burner, an installation of which, at the Clarksburg Glass Company, Clarksburg, W. Va., was described in our December number, are given by John G. Hess, Jr., as follows:

> "The tank of the Clarksburg Glass Company is of 36-blower capacity, and they are now using the four-shift system of twelve blowers each, or a total of 48 blowers. The four-shift system, as you know, saps the very vitality out of a tank built only for 36 blowers working three shifts, and for the new preheating burner to be standing up under these conditions speaks volumes for it.
>
> "They are using as low as 22 tons of coal in 24 hours and are filling in 1,800 lbs. of batch and 1,800 lbs. of cullet every hour out of twenty-four. They are now burning approximately 500,000 feet of producer gas per day, while they formerly used between 750,000 and 800,000 feet of natural gas per day on their tank, and with natural gas now costing 40 cents per thousand feet, you can readily see it is much cheaper to use the producer gas."

A distinctive feature claimed by the inventor of the Hess furnace is that it does away with the necessity for building an additional set of checkers when changing a tank from natural to producer gas, and that in a new plant it accomplishes with a single set of checkers a thorough intermingling of the gas and heated air before entering the combustion chamber, thus saving the cost of building a second set of checkers. Marked economy in fuel is also claimed.

Gas Producers Conserve Fuel*

In the development and use of our fuel supply there has been a notable disregard for coming generations. Our consumption of coal, oil, natural gas and wood for house-warming, power and industrial furnaces is accompanied by a great preventable waste. So large is the consumption of our resources that we are feeling already an economic shortage of fuel. The inferior fuels, such as lignite, peat and oil shale are being studied or tested as a possible source of supply. We are brought to realize that we owe it to ourselves, as well as the coming generation, to conserve our fuel by selection of proper processes for its use.

The moment that we leave generalizations for actual measurements, we have made the first step in conservation. Our "yardstick" in this instance is the British thermal unit. This is the amount of heat required to raise one pound of water from a temperature of 39 degrees to 40 degrees Fahr. With this unit, we can measure the total potential heat in a fuel and the amount of heat used. The ratio of these two quantities is the measure of the efficiency of the transformation. The efficiency of fuels, processes, and furnaces may be measured accurately and expressed in numerical figures. For instance, a certain manufacturer found his fuel bills high and his operation unsatisfactory. He called in an engineer who prepared a balance sheet of his fuel expenditures, just as a bookkeeper prepares a trial balance of financial operations. This fuel account is called a "heat balance." On one side is charged the potential heat energy of the fuel, on the other side appear items of expenditure such as useful work, together with the losses from radiation, heat carried away by chimney gases, leakage, and otherwise. Every heat unit is accounted for and shown on both sides of the record. In this case, the useful work was found to be only 4½% of the total heat of the coal. The waste was 95½%. The cause was burning raw coal in an inappropriate manner.

It has been known for many years that burning coal on grates for the various furnaces used in the arts is a wasteful process and that better results are had when the fuel is first gasified and the gas burned in a suitably designed furnace. The reasons are that complete combustion is possible, higher temperatures are obtained, chimney gas wastes are reduced, carbon losses in the ashes practically eliminated and better regulation of the whole process is possible when using gas.

The conversion of solid fuel into gas is simple in theory, consisting of blowing air and steam through an incandescent fuel bed, distilling the volatile hydro-carbons and converting these with the solid carbon of the coal into combustible gas. In practice, the thermochemical operation of gas making is consequent upon the mechanical operation of feeding the raw coal into the producer properly, the removal of the ashes and the regulation of the operation to insure uniformity and richness of the gas with a minimum coal consumption and the smallest possible attention of the operator. So effectively have these aims been achieved in the most efficient type of producer that one man can take care of more than one producer, each converting into gas from 2,000 pounds of coal per hour, making from 130,000 to 190,000 cubic feet of gas.

The first gas producers were of European origin. The highest developments have been reached through study and practice in America and gas producers are built here and shipped to Europe, Asia and Australia.

The developments in construction have been ever with a view of greater conservation of fuel, labor and investment. The result is that the present producer is mechanical in its coal feeding, ash removal and working of the fire. In fact gas making from the coal arriving in the cars to the ashes leaving the car and gas going into the gas main is now a mechanical operation.

The measure of success is the delivery of gas containing 92.3 per cent of the potential heat of the original coal. This figure is arrived at under working operations.

Further refinements, leading to more uniform quantity and a better quality of the producer gas, are the blowing of the air blast into the producer with a turbine driven fan, the exhaust steam of which is decomposed in the combustion zone of the producer into hydrocarbon gases; and equipping the producer with a pyrometer, blast and gas pressure gauges and hygrometer to regulate the steam used.

* From the Engineering Department of the Wellman-Seaver-Morgan Company.

Trade News

ITEMS OF INTEREST REPORTED DURING THE PAST MONTH

THE HYGEIA GLASS CORPORATION has purchased the bottle manufacturing plant of the Industrial Glass Company at Lancaster, N. Y.

THE EDWARD FORD PLATE GLASS COMPANY plant, Toledo, O., employing fifteen hundred men, was shut down on December 24th until February 1st.

M. JACOB & SONS, wholesale dealers in bottles, etc., have removed their warehouse and offices from 527-537 Beaubien street, to 2903 Beaubien street, Detroit, Mich.

THE CAPSTAN GLASS COMPANY, South Connellsville, Pa., has increased its capital from $500,000 to $2,500,000. The company is now making improvements in its plant which will about double the capacity of the plant.

Fire on December 19 caused about $1,000 damage to the gashouse of the AMERICAN GLASS WORKS, INC., Richmond, Va., and resulted in the closing down of the plant for about 10 days. The fire did not do any damage to the main plant.

THE LOUDEN GLASS DIVISION of the National Lamp Works of the General Electric Company, Fostoria, O., employing 125 men, closed permanently on December 10. A new plant for making glass tubing by machinery, which displaces hand workers, has been installed at Bridgeville, Pa.

THE NATIONAL LAMP WORKS of the General Electric Company, Cleveland, O., is erecting a two-story factory, 82 by 132 feet in size, at 757 East Ferry street, Buffalo, N. Y. The estimated cost of the new plant is $120,000 and it will be devoted to the manufacture of lamp making machines.

THE NATIONAL WINDOW GLASS COMPANY, Cedar Grove, La., according to a press report, will close its plant January 15, the shutdown marking the end of the 1920 blowing season at the plant. The factory will open for the 1921 season early in the fall and during the closed season will be thoroughly overhauled.

THE WHITTEMORE GLASS COMPANY'S building at Dunbar, W. Va., according to Mark Beazley, vice-president and treasurer, is now under roof and is almost ready for the installation of machinery and they expect to resume work, which was suspended due to fire destroying the plant last spring, at an early date.

The stockholders of the HAZEL-ATLAS GLASS COMPANY, Wheeling, W. Va., at the annual meeting held December 7th, elected the following members of the board of directors for the coming year: C. R. Hubbard, J. J. Holloway, C. A. Robinson, W. S. Brady, W. H. Boshart, J. D. Biggers, G. G. Oliver, C. N. Brady and J. C. Brady.

THE NORFOLK GLASS MANUFACTURING COMPANY, Norfolk, Va., reports that in the near future it expects to install another tank and iehr in addition to the 25-ton tank and two continuous muffle lehrs which they now have in operation. The company, which is a new concern, is using a Hughes mechanical gas producer in connection with the above equipment.

THE LIBBEY GLASS MANUFACTURING COMPANY, Toledo, O., has announced that beginning January 1, 1921, it will carry life insurance for all its employees who have been in service six months or more. The insurance, which will be based on length of service, will be written so as to protect the families of the employees in case of death or total disability.

THE TRI-STATE GLASS COMPANY, recently formed at Toledo, O., with an authorized capital of $200,000, has acquired the former plant of the Toledo Bottle Company at East Toledo. The Tri-State Company has remodeled the plant and expects to have it in operation within a short time. David Pugh, formerly with the Coshocton Glass Company, Coshocton, O., will be general manager.

DAVID W. BARRY, superintendent of the Libbey Glass Manufacturing Company, Toledo, O., retired on December 31, 1920. Mr. Barry was connected with the company in various capacities for 53 years. In appreciation of his faithfulness, fairness and devotion, Mr. Barry received from the employees a set of flat silver and on behalf of the company, E. D. Libbey, who was president of the company until last year, presented Mr. Barry with a gold watch and chain.

THE STANDARD GLASS COMPANY, Marion, Ind, has awarded the contract for the erection of a new fire-proof factory to cost approximately $32,000 to the Indiana Bridge Company. The contract calls for complete erection by February 6th. The main factory building will be of a steel frame, corrugated asbestos roof and siding and will take the place of the buildings which were recently destroyed by fire.

THE GLASS AND POTTERY EXHIBIT for 1921 is now open and will continue until the last week of the month, at the Fort Pitt Hotel, Pittsburgh, Pa. There are a large number of exhibitors and they include as well as glassware and pottery manufacturers, lamp and fixture makers, importers and wholesale distributors. The Western Glass & Pottery Association will hold its annual banquet on January 17, at the William Penn Hotel.

CORNING GLASS WORKS, SOUTHERN DIVISION, Kingsport, Tenn., reports that although the plant is not completely finished they were able to start the manufacture of Pyrex baking ware on December 9. One furnace is now in operation and the second furnace will probably be in operation within the next three months. They also state that when the plant is completely finished they will employ in the neighborhood of 400 people. The erection of this plant was started on October 15, 1919, and when completed it will have cost $1,000,000.

THE CENTRAL GLASS WORKS, Wheeling, W. Va., manufacturers of pressed and blown glassware, are making further improvements to their plant including the addition of a new boiler house, which will contain two additional boilers; one to be used for operating the new Hughes mechanical gas producer, which is expected to be in operation by February 15, and the other to furnish heat for the entire plant. An extra fifteen thousand gallon oil tank has also been ordered which will give the company a capacity of approximately forty thousand gallons which will be used as reserve fuel. Further improvements include a new concrete floor to replace the present brick one in the factory and the mold shop is also being made fire-proof by replacing the wooden floor with a concrete one. A new fire alarm system is being installed, consisting of fourteen boxes, which will ring from the various departments in case of fire and show on a chart at the nearest fire station in just which department the fire is located.

Trade Literature

FRINK HINTS for December, 1920, published by The Frink Decolorizer Company and The Frink Pyrometer Company, Lancaster, O., contains, as usual, 16 pages of quips and comments, instructions for using Frink products and an announcement of a price reduction effective December 1, 1920, on Frink Decolorizer and Anti-color.

The latest issue of DOUBLE-S FAX, published by the Sharp Schurtz Company, Lancaster, O., contains an abstract of a brief filed by Louis D. Brandeis with the Interstate Commerce Commission in connection with its investigation of freight rates and which deals with the subject of scientific management. Arsenic, arsenic as a poison, and powdered blue are subjects which are also treated in this edition.

The December issue of the BOTTLING AND PACKAGING ENGINEER, a house organ published by the U. S. Bottling Machinery Company, 2511 Park Avenue, Chicago, Ill., contains illustrations and descriptions of several of the company's modern bottle filling, corking and conveying machines. This company offers to assist in solving any problems of preparing, storing, filtering, filling, corking, capping, labeling, packaging and conveying liquid, paste, pulp and powdered products in any volume.

Miscellaneous Items

During November, 1920, the number of workers employed in the glass trade in New York State increased 8 per cent over October, according to the monthly report of the New York State Industrial Commission.

An American Consul has reported a case of non-delivery of a parcel-post package which has been greatly complicated by the fact that the shippers failed to give the registration number of the package in their invoices. This occurrence, says the Bureau of Foreign and Domestic Commerce, emphasizes the importance of showing this number in the invoices in all cases of foreign parcel-post shipments.

Window glass in Japan is maintaining a high price, according to the *Far Eastern Review*, due to the regulation of demand and supply. The Asahi Company, which supplies 90 per cent of the domestic demand, has increased its pre-war capital of 2,000,000 to 12,500,000 yen. This company exports something like 100,000 cases of glass per year to China, Australia, South America, and other countries.

The output of the Argentine glass factories is insufficient to supply the demands of industries such as the cologne distilleries, which need large quantities of containers of fancy shapes. The approximate consumption of bottles by this one industry alone is 1,000,000 per month. Earlier in the season the shortage was so acute that one manufacturer of perfumery was unable to fill orders for certain articles for which his supply of containers was exhausted. According to Trade Commissioner Smith, one factory, which has an annual output of 20,000 tons of glass of all

sorts, has posted notices advising that it will accept orders only from old clients and that no new molds will be made before the end of the year.

An interesting decision was recently handed down by the High Court of England on an application by a man named Evans, a stockholder in Brunner-Mond & Company, Ltd., manufacturers of soda ash and other chemicals, for an injunction to prohibit the company from donating the sum of £100,000, which had been appropriated by the board of directors to be contributed to various scientific institutions throughout the United Kingdom for the purpose of furthering chemical research. After considering all the facts in the case, the judge decided that the contribution was justified as a business proposition on the ground that new discoveries and improvements in the chemical field would, in the end, redound to the benefit of the company and its stockholders.

According to the *Manufacturers' Record,* Baltimore, Md., Joaquin Paya, Encarnacion 14, Valencia, Spain, is very anxious to enter into relations with manufacturers of "flat crystals," such as window glass, etc., as well as with manufacturers of bottles for wines, liquors and medicines. He is going to extend his business in the line of glasses and also table utensils, but the importation of bottles into his country is of first importance. At this time he has orders on file for all sizes and models amounting to over 1,000,000 bottles. He has placed an order for only one type of these bottles (for over 400,000) with the Baylees Manufacturing Company of Memphis, Tenn., but is at a loss to place any other orders for he does not know any firms manufacturing these articles.

Libbey-Owens Sheet Glass Company Annual Report

The report of the business and operations of the Libbey-Owens Sheet Glass Company, submitted by President E. D. Libbey to the stockholders at their annual meeting at Toledo, O., December 8, 1920, covered the most favorable year in the company's short history. The financial report printed below shows a manufacturing profit, after deducting cost of sales, general and selling expenses, of $4,736,500.44 and other income of $53,223.01, leaving, after deducting $563,085.11 for depreciation of patents and other miscellaneous expenses and reserving $2,225,000 for Federal taxes and contingencies, a net profit to surplus of $2,001,638.34.

President Libbey reported that three of the machines in the new addition at the Charleston, W. Va., plant are now in operation and the remaining three now being erected will soon be ready for use. Additional natural gas acreage was acquired during the year which assures a long continued source of supply. The six machines in the original plant operated at 94.4% full capacity during the year. Improvement in the development of heavy glass has been made and further progress is promised.

In all, seventeen of the automatic sheet glass machines have been delivered, comprising twelve at Charleston, three in Japan and two in Canada. Twelve additional machines are being manufactured for future use. Licenses for the use of the company's inventions have been issued to the following companies: Pacific Libbey-Owens Sheet Glass Company, a non-exclusive license for two machines, and Canadian Libbey-Owens Sheet Glass Company, Ltd., exclusive license in Canada for two machines. As reported at the last annual meeting the Japanese rights have been sold and the Japanese plant was successfully started in operation on October 1, 1920.

A parent company has been organized in Belgium which will license subsidiary companies to be organized in various European countries. The parent factory to be built in Belgium will be a twelve machine plant with all of the latest American improvements.

President Libbey announced that the preferred stock of the company would be increased to $5,000,000 of a par value of $100 per share, and common stock to $10,000,000 with a par value of $25 per share. The financial report follows:

ASSETS.

CURRENT CASH—			
On hand	$758.90		
On deposit	945,912.11		
		$946,671.01	
U. S. GOVERNMENT SECURITIES—			
War Saving Certificates	885.60		
Liberty Bonds, various issues	$55,000.00		
Accrued interest	791.87	55,791.87	
		56,677.47	
ACCOUNTS RECEIVABLE—			
Customers	$361,058.54		
Less: Allowance for doubtful discounts, etc.	21,000.00		
	$340,058.64		
Creditors' debit balances	159.04		
		340,217.68	
MERCHANDISE INVENTORY—			
Miscellaneous	$617,256.36		
Material in transit	27,803.19	645,059.55	$1,988,625.71
OTHER ASSETS—			
Miscellaneous accounts receivable, claims and advance payments on machines			714,175.54
INVESTMENTS—			
The American-Japan Sheet Glass Company		$453,175.00	
The Libbey-Owens Sheet Glass Development Company, Ltd.	$668,898.75		
Less: Uncalled subscription	444,093.75	224,805.00	
			677,980.00
PERMANENT—			
Land		$46,485.20	
Buildings, machinery, equipment, etc. (depreciated values)		4,170,105.23	
			4,216,590.43
OTHER REAL ESTATE—			
Employees' houses (depreciated value)			59,945.90
PATENTS—			
Depreciated Value			3,258,641.82
DEFERRED—			
Unexpired insurance premiums and prepaid taxes, etc.			20,495.11
			$10,936,454.51

LIABILITIES.

CURRENT—ACCOUNTS PAYABLE—			
For purchases, expenses, etc.	$398,998.99		
Unpaid payroll	33,327.09		
Customers' credit balances	1,522.58		
Unclaimed wages	86.76		
The Libbey-Owens Sheet Glass Development Company, Ltd.	45,656.10		
		$479,591.52	
ACCRUED—			
Taxes		40,003.72	
			519,595.24
RESERVE—			
For repairs		$51,333.07	
For Federal taxes and contingencies, estimated)		2,275,000.00	
			2,326,333.07
NOMINAL—CAPITAL STOCK—			
PREFERRED—7% CUMULATIVE—			
Authorized and issued	$2,000,000.00		
COMMON			
Authorized and issued	4,000,000.00		
		$6,000,000.00	
PROFIT AND LOSS—SURPLUS—			
Balance September 30th, 1920		2,090,526.20	
			8,090,526.20
			$10,936,454.51

Note—Accrued and unpaid dividends on the preferred stock at September 30th, 1920, amounted to $210,000.00.

INCOME.

MANUFACTURING PROFIT—	
After deducting cost of sales, general and selling expenses	$4,736,500.44
OTHER INCOME	53,223.01
TOTAL INCOME	$4,789,723.45
LESS—	
Depreciation of patents and miscellaneous expenses, including license, patent, European and experimental, expenses, provision for doubtful accounts, etc.	563,085.11
PROFIT BEFORE PROVIDING FOR FEDERAL TAXES AND CONTINGENCIES	$4,226,638.34
RESERVES FOR FEDERAL TAXES AND CONTINGENCIES (Estimated)	2,225,000.00
NET PROFITS TO SURPLUS	$2,001,638.34

Leo A. Drey

LEO A. DREY, president of the Schram Glass Manufacturing Company, St. Louis, Mo., died on December 22. Mr. Drey was born in 1876 and came of a family whose name has been identified with the glass industry for the past 50 years, both in Europe and this country. The Schram Glass Manufacturing Company has grown from relatively modest beginnings to large proportions and operates three factories in this country and has affiliations in Canada.

MONTHLY SUMMARY OF FOREIGN COMMERCE OF THE UNITED STATES.

Corrected to December 2, 1920.

IMPORTS OF GLASS AND GLASSWARE.

Articles	October 1919 Quantity	October 1919 Value	October 1920 Quantity	October 1920 Value	Nine months ending October 1918 Quantity	1918 Value	1919 Quantity	1919 Value	1920 Quantity	1920 Value
Glass and glassware:										
Bottles, vials, demijohns, carboys, and jars, plain, ordinarily used as containers, empty or filled ....lbs. dut.	332,933	$19,506	755,389	$33,019	.....	$94,444	1,518,129	$84,729	5,158,461	$240,541
Bottles, decanters, and other glassware, cut or ornamented....dut.	.....	34,981	.....	204,897	.....	262,500	.....	321,757	.....	933,917
Optical instruments, including lenses and spectacles ....dut.	.....	19,241	.....	101,971	.....	125,791	.....	222,696	.....	747,587
Sheet and plate glass—										
Cylinder, crown, and common window glass, unpolished ....lbs. dut.	115,775	15,525	435,522	50,469	364,541	46,922	671,698	84,452	4,342,813	449,688
Plate glass, cast, polished, unsilvered. sq. ft. dut.	4,162	3,050	394,667	355,278	273	210	4,173	3,055	1,780,316	1,493,492
Plates or disks, rough-cut or unwrought, for optical purposes....lbs. free.	65,165	41,154	56,212	81,257	.....	273,283	485,426	333,228	736,624	816,352
All other ....dut.	.....	58,602	.....	339,208	.....	413,988	.....	496,128	.....	1,735,346
Total	.....	192,059	.....	1,166,099	.....	1,157,138	.....	1,546,045	.....	6,416,823

EXPORTS OF GLASS AND GLASSWARE.

Glass and glassware:										
Bottles, demijohns, carboys and jars....	.....	$410,666	.....	$690,767	.....	$2,329,244	.....	$4,141,541	.....	$8,007,387
Chemical glassware	.....	10,159	.....	21,710	.....	137,854	.....	156,579	.....	263,638
Common window glass, boxes (50 sq. ft.).	86,295	594,806	48,130	349,263	574,257	3,063,508	824,692	5,640,044	509,691	3,483,406
Exported to:										
France	400	2,566	.....	.....	.....	.....	208,890	1,670,900	94	698
Canada	33,596	188,453	23,914	162,638	338,531	1,585,028	159,971	870,151	258,079	1,610,336
Mexico	643	5,205	1,265	11,381	12,734	80,786	18,727	137,539	25,374	207,171
Cuba	3,643	23,674	1,889	20,540	26,938	151,517	16,084	115,609	30,517	232,127
Argentina	2,793	21,169	3,072	18,850	38,145	271,882	86,661	607,491	18,551	246,844
Brazil	9,668	81,477	3,651	26,776	17,660	106,686	62,955	421,995	31,112	221,480
Chile	6,549	42,975	683	4,938	43,084	259,807	32,098	214,839	11,918	73,283
Uruguay	.....	.....	3,925	29,002	.....	.....	.....	.....	8,858	60,240
China	.....	.....	2,455	14,792	.....	.....	.....	.....	25,605	173,651
Japan	1,594	15,756	2,359	20,219	4,604	32,920	11,078	114,513	22,118	178,809
Australia	2,527	16,776	118	1,185	39,075	239,736	99,863	604,547	9,855	76,917
New Zealand	68	405	425	4,211	3,170	17,150	24,941	140,198	3,480	27,841
Other countries	24,814	196,350	4,383	34,731	50,316	323,996	103,415	742,262	64,130	474,000
Cut or engraved glassware....	.....	33,493	.....	46,231	.....	112,018	.....	210,505	.....	351,553
Plate glass, unsilvered....sq. ft.	433,752	266,526	209,855	161,691	4,657,341	2,378,638	6,790,952	3,943,795	3,576,048	2,374,476
All other	.....	727,013	.....	1,173,724	.....	4,317,936	.....	6,759,188	.....	9,802,752
Total glass, etc....	.....	2,042,663	.....	2,443,386	.....	12,339,198	.....	20,851,652	.....	24,223,212

SHIPMENTS FROM THE UNITED STATES TO ALASKA.

Glass and glassware	.....	$4,981	.....	$12,161	.....	$47,008	.....	$53,702	.....	$81,074

SHIPMENTS FROM THE UNITED STATES TO HAWAII.

Glass and glassware	.....	$6,135	.....	$58,895	.....	$148,280	.....	$178,291	.....	$371,138

SHIPMENTS FROM THE UNITED STATES TO PORTO RICO.

Glass and glassware	.....	$24,716	.....	$56,861	.....	$164,218	.....	$179,716	.....	$369,275

Current Prices of Glass-Making Materials

From quotations furnished by various manufacturers and dealers

January 5, 1921

	Carlots	Less Carlots
Alumina Hydrate .....lb.		.12 – .14
Alumina-Oxide .....lb.		.12
Antimony-Oxide		.11 – .12
Arsenic Trioxide, Dense White, 99% .....lb.	.12	.12½
Barium Carbonate .....lb.		.05 – .06
Barium Hydrate .....lb.		.07
Bone Ash .....lb.		.10 – .10½
Borax .....lb.		.07 – .08½
Cadmium-Sulphide .....lb.		2.00 –2.50
Cobalt-Oxide .....bbl.		4.00
Cobalt-Oxide .....10-lb. tins		4.10 –4.25
Copper-Oxide, Red.....lb.		.50 – .55
Copper-Oxide, Black .....lb.		.25 – .35
Feldspar .....lb.	.01¼– .01½ (X works)	.02 (N. Y.)
Fluorspar .....lb.	.02¼	.03 – .03½
Kryolite .....lb.		.15
Lead-Oxide (Red Lead Pb_3O_4) .....lb.	.10¼	
Litharge (PbO)	.09¾	.10
Nickelic Oxide (NiO).....		.55
Nickelous Oxide (Ni_2O)...lb.		.60
Manganese .....lb.		.04½– .06
Potassium Carbonate		.10 – .13
Potassium Nitrate		.15
Powdered Blue .....lb.		.30 – .40
Salt Cake .....ton		35.00
Selenium .....lb.		2.25 –2.50
Sodium Nitrate .....lb.		.02¾– .07
Soda Ash—58% dense (f. o. b. Works, 1921 delivery, 48% basis), bags .....100 lbs.	1.95 –1.97½	2.05
Sulphur (Flowers) .....lb.		.04 – .04¼
Uranium Oxide .....lb.		2.50 –3.50
Zinc Oxide (ZnO).....lb.		.11 – .18

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Building, Pittsburgh, Pa.)

New York, January 10.

	Bid	Asked
Libbey Owens Sheet Glass, common.....	...	...
Libbey Owens Sheet Glass, preferred.....	...	...
Owens Bottle Machine, common, last sale 44½..	...	...
Owens Bottle Machine, preferred.....	...	100

Pittsburgh, January 8.

	High	Low	Last
Am. Window Glass Mch., common.....	...	...	109
Am. Window Glass Mch., pfd., asked 85..	...	...	...
Am. Window Glass, preferred.....	...	...	101½
Pittsburgh Plate Glass.....	116	113½	115
United States Glass.....	...	...	57½

Wheeling, January 10.

	Bid	Asked	Last
Fostoria Glass Co.....	105	105	105
Hazel-Atlas Glass Co.....	150	148	150
Imperial Glass Co.....	88	88	88